NOVEMBER 16, 1953

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

Silicone in Plant Auxiliaries
Page 112

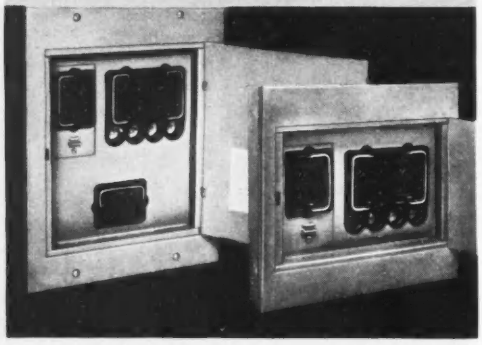
Keying Transformers to Load
Page 116

Shooting Trouble with Radar
Page 118

How to Duct-Splice Cable
Page 124

NEW MURRAY "PJ" LINE CUTS COSTS...SAVES TIME!

MURRAY FUSIBLE "PJ" LINE OF SIX BASIC DISTRIBUTION PANELS



This 60-amp fusible equipment comes with 3 or 4 pull-outs and 4, 6 or 8 branch circuits, in series or parallel. Handles almost any load combination. Panels have dead front construction, are finished in attractive baked-on grey Melamine. Famous Murray quality throughout

Everything: Main, Lighting & Appliance, and Power circuits—complete in one compact box. Everything goes up at one time. Note special sealable compartment containing one pullout—ideal for separate rate off-peak water heating. Barrier removable when not required

. . . helps you meet increased loads at decreased costs!

The attractive, low-cost PJ line is designed to help you handle increased loads on home, farm and commercial jobs with a minimum of equipment. With only six basic panels you get full-line versatility for almost any combination of light, appliance and power circuits. Minimum-stock line also means easier ordering and stocking for you.

. . . saves you more time and money on installation!

Putting up PJ panels is clean, fast work with installation time cut to the bone. There are plenty of clean-cut, easy-to-remove KO's just where you want them. Plenty of knuckle room, too. And no wire fumbling—you'll find high quality solderless connectors on all terminals conveniently located. Surface hook-on cover saves extra time.

In every way, Murray PJ panels are ideal for low-cost installations. Your Murray wholesaler has them now. Lay in a supply today and be ready for any job that comes along.

For complete details and wiring diagrams, ask your wholesaler for Bulletin 231, or send the coupon in.

send coupon today!

MURRAY MANUFACTURING CORPORATION

Murray®

1250 Atlantic Ave., Brooklyn 16, N. Y.

Service Entrance & Meter Equipment • Fully Magnetic Circuit Breakers • Switches (Types A, C & D) • Current Limiting Reactors • Crows' Nest Aerial Ladders

Murray Manufacturing Corporation, 1250 Atlantic Avenue, Bklyn. 16, N.Y.

Gentlemen: Please send me Bulletin 231 on the new Murray PJ series of distribution panels.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

Meet This Week's Writers

How silicone glass can help solve power plant insulation problems is interpreted on page 112 by John G. Noest, assistant Inside Plant engineer for Consolidated Edison Co of N. Y.

J. G. NOEST

Born in Austria in 1904, Noest came to the United States in 1923, after receiving an electrical engineering degree at the University of Berlin. That year he joined Brooklyn Edison Co, a subsidiary of Consolidated Edison, as a dynamoman. He and his wife, the former Elizabeth Barth of Budapest, Hungary, reside in Manhasset, N. Y.

Charles L. Wagner, who on page 127 discusses the analog computer known as Anacom, is an electric utility engineer in Westinghouse Electric Corp's Industry Engineering department. As Chuck puts it, he is related "by marriage only" to his father, Dr. Charles F. Wagner, who has received wide recognition as a power engineer since joining Westinghouse 35 years ago.

C. L. WAGNER

The younger Wagner, who received an undergraduate degree in electrical engineering from Bucknell University and his master's from the University of Pittsburgh, joined Westinghouse as a graduate student in 1946. His current responsibility is to contact utility and industrial customers in the Southeast.

He uses part of his travel time through the territory getting a photographic record of interesting sections of various towns he visits. One of his favorites is a picture story of the French Quarter in New Orleans. Remainder of his leisure is used up in his workshop and on the golf course.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are accepted from executive, supervisory and engineering personnel in electric utilities, manufacturing companies, and related fields. Positions and company connection must be indicated on subscription orders.

Single copies 35¢. For the United States and Possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in USA.
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This advertisement reproduced the results of tests made on an Okonite-Callender paper-insulated cable in 1949.

The advertisement reproduced here appeared four years ago. The story it told then remains true today—that is, that the first length of lead-sheathed cable furnished with an Okosheath Protective Covering back in 1933 is still operating successfully in a highly-corrosive location. Since then, many hundreds of thousands of feet of cable protected by Okosheath Protective Covering have been installed, AND WE HAVE YET TO RECEIVE A REPORT THAT A SINGLE LENGTH HAS FAILED BECAUSE OF CORROSION.

Today over half the lead-sheathed cables supplied by Okonite-Callender have Okosheath Protective Coverings specified by the user—not only to protect against corrosion and electrolysis, but to reduce the danger of sheath scoring during installation.

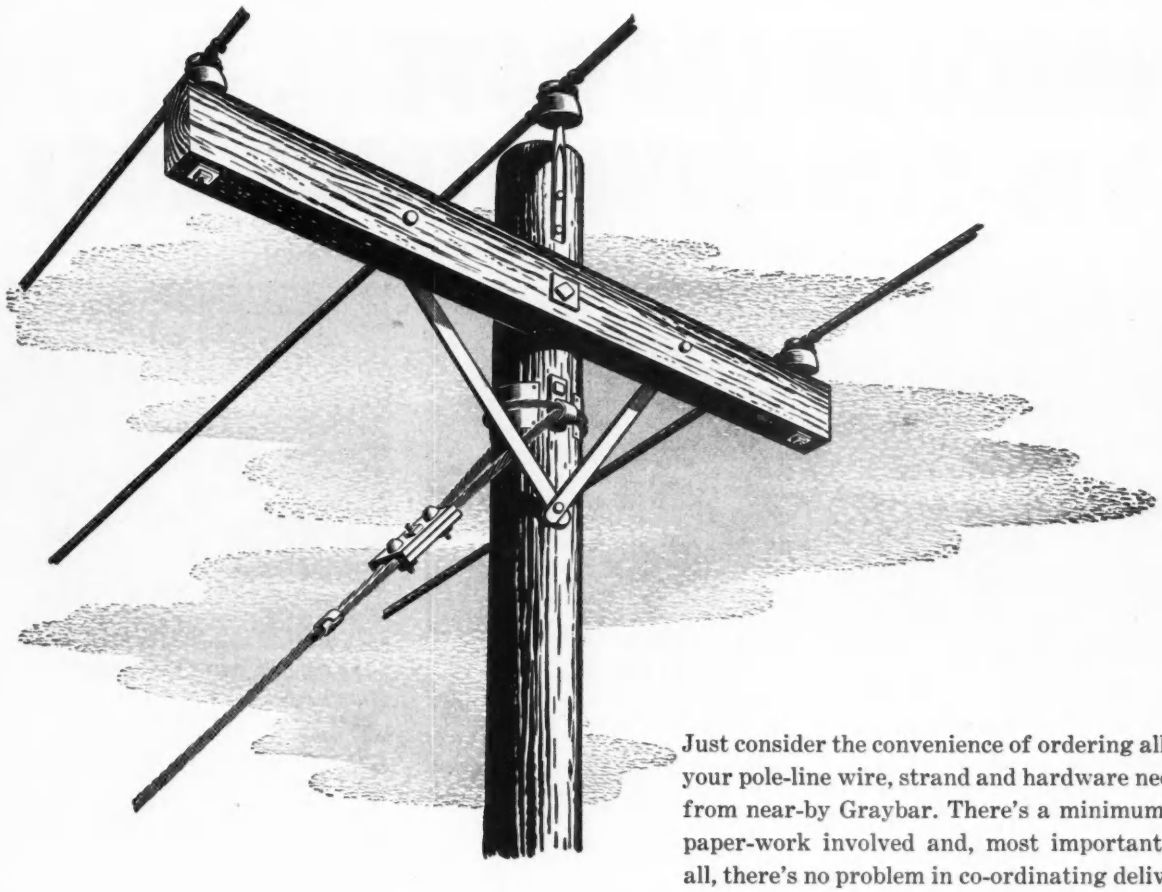
When the Okosheath Protective Covering is used in combination with an Okometal alloyed sheath, the composite construction permits a reduction in the thickness of metal required, and a corresponding saving in cost. Wherever a paper power cable is required, the advantages of the Okonite-Callender composite sheath should be considered. Detailed information may be obtained by writing for Bulletin EW 1047. The Okonite Company, Passaic, N. J.

1859

OKONITE insulated cables

OKONITE SINCE 1878

75th ANNIVERSARY



Just consider the convenience of ordering all of your pole-line wire, strand and hardware needs from near-by Graybar. There's a minimum of paper-work involved and, most important of all, there's no problem in co-ordinating deliveries from numerous widely-separated suppliers.

Graybar thoroughly understands the needs of the nation's power companies . . . can furnish supplies and materials "from the bottom of the hole to the top of the pole." Graybar Outside Construction Specialists are always ready to help you plan or carry out any project.

Taken all together, you can see why it pays to call Graybar first for everything electrical . . . routine or emergency. *Graybar Electric Company, Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.*

311-911

LINE WIRE STRAND HARDWARE

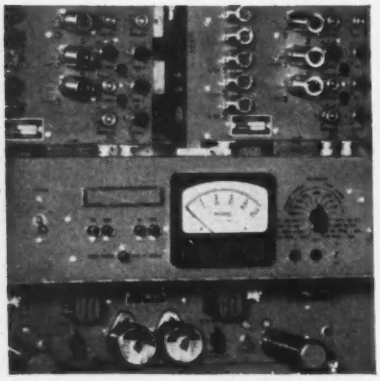
...all via GraybaR

Call Graybar first for...

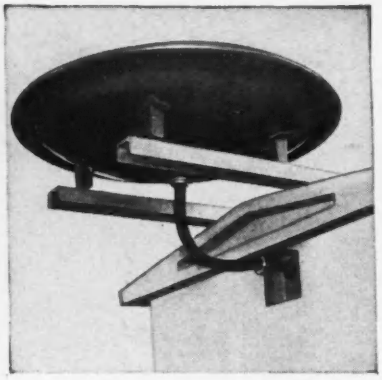
Graybar Everything Electrical Graybar Electric Company

IN OVER 100 PRINCIPAL CITIES

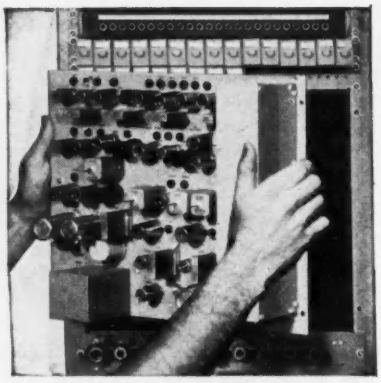
PHILCO MICROWAVE CUTS COMMUNICATIONS COST



TEST JACKS AND BUILT-IN METERING
Field circuit analysis simplified by built-in metering and test points on every major circuit for instantaneous monitoring of any current or voltage.



ANTENNA-REFLECTOR SYSTEM
Tower climbing eliminated for routine checks since antennas are mounted at ground level, easily accessible for maintenance.

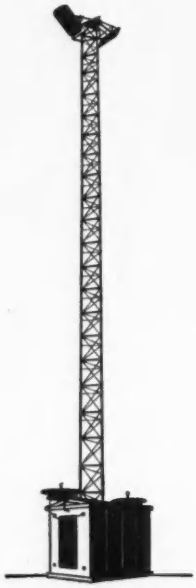


"PACKAGED UNIT" COMPONENTS
Field maintenance time and cost saved. All assemblies removable with only the use of a screwdriver for quick field replacement and depot checkout.

Reduce your communications cost with Philco microwave. Thousands of your communications dollars will be saved by the cost cutting features built into each Philco unit. Philco engineers know there is no substitute for quality and low maintenance cost.

That is why Philco microwave is built to Joint Army-Navy Specifications and why Philco's exclusive design slashes field maintenance time with built-in metering and test points on all major circuits . . . eliminates tower-climbing for routine checks with passive reflector-antenna system...allows quick field replacement of major assemblies with Philco's exclusive "packaged unit" components, removable with only a screwdriver.

Look to Philco microwave to cut your communications cost.



For full information write to Department EW

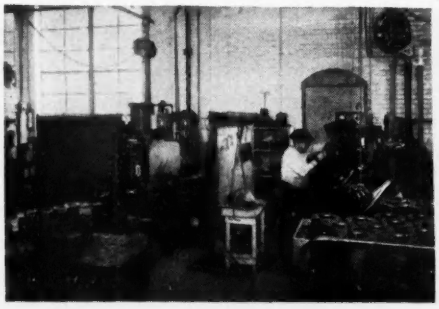
PHILCO Famous for QUALITY the World Over

PHILCO CORPORATION

GOVERNMENT & INDUSTRIAL DIVISION

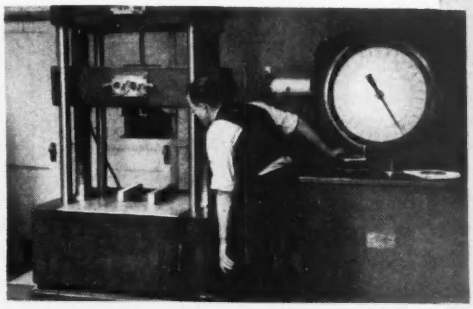
PHILADELPHIA 44, PA.

Why Grinnell is America's #1 Supplier of PIPE HANGERS *and* SUPPORTS



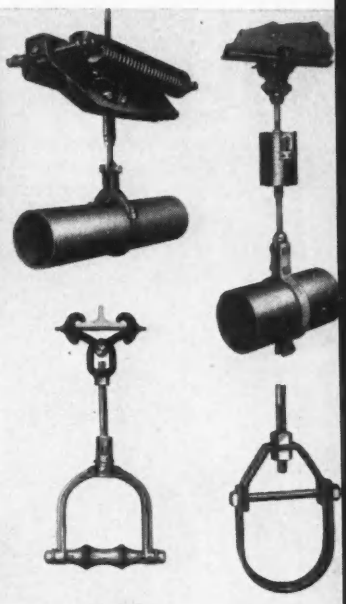
GRINNELL, ALONE, MANUFACTURES A FULL LINE OF HANGERS AND SUPPORTS

No other company, anywhere, makes a line as complete or varied. Grinnell produces hangers in thousands of combinations to support any piping.

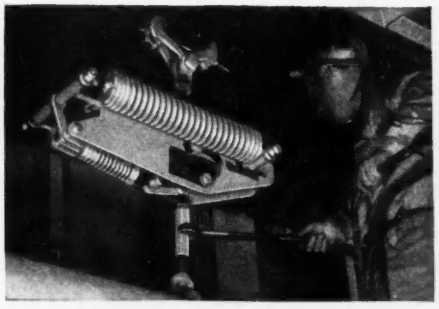


GRINNELL, ALONE, MAINTAINS AN EXPERIENCED LABORATORY STAFF OF TRAINED TECHNICIANS

In its modern, well-equipped laboratory, tests are constantly being made to discover better ways of solving old and new pipe suspension problems.



Grinnell makes scientifically designed, ruggedly built pipe hangers and supports for every type installation.



GRINNELL, ALONE, PROVIDES ENGINEERING ASSISTANCE IN DESIGN AND INSTALLATION

Grinnell makes available specialized knowledge in the computation of hanger loads and the selection of the correct supports. Engineers in the field assist with problems in erection of pipe hangers.

GRINNELL, ALONE, THROUGH ITS CONVENIENT WAREHOUSES CAN SUPPLY YOU "OUT OF STOCK"

No manufacturer of pipe hangers offers a distribution system as thorough or efficient. Grinnell warehouses are located in 30 principal cities . . . with jobbers in practically every city, coast to coast.

Pipe suspension presents an extremely wide range of problems involving weights, stress, thermal movement, materials and specialized engineering. No one "goes into" the pipe hanger business overnight. Large manufacturing facilities, skilled technicians, and a lot of down-to-earth practical experience are needed.

Grinnell has become America's No. 1 supplier of pipe hangers and supports only because Grinnell has specialized in piping for one hundred years. Grinnell has developed a line of pipe hangers and supports for every piping requirement, from the simplest to the most complex.

Grinnell is always ready to co-operate with engineers and architects in the preparation of pipe suspension specifications.

Call Grinnell for any and all types of pipe hangers and supports.

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Sales Offices and Warehouses in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports
Thermolier unit heaters • valves • Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies • industrial supplies
Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems

SANGAMO... the Demand Registers with service experience

Economical operation of demand meters depends on how often the registers must be given necessary maintenance.

Sangamo's New Service Manual recommends that Sangamo Demand Registers be subjected to only a *minimum* of preventive maintenance. Field service records show that these registers operate satisfactorily for from 4 to 12 years.

HERE ARE THE REASONS Type JH and LCH Registers can give such performance . . .

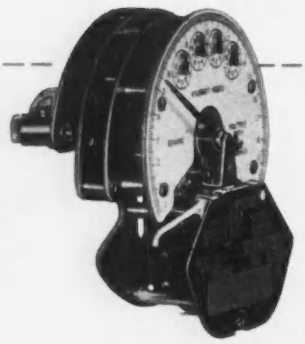
1. The exclusive Sangamo-built slow speed, high torque motor with porous, lubricant-saturated bronze bearings. Result: *No motor trouble.*

2. Hardened steel pivots and porous lubricant-saturated bronze bearings. Result: *Friction does not develop in timing gearing.*

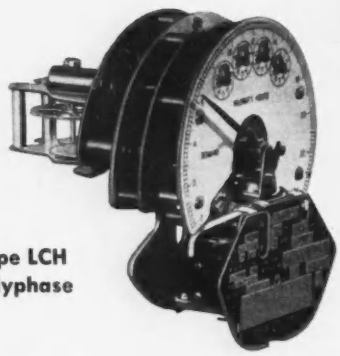
3. Jewelled bearings in resetting mechanism. Result: *Makes resetting positive and friction-free.*

These design features assure economical operation and complete satisfaction.

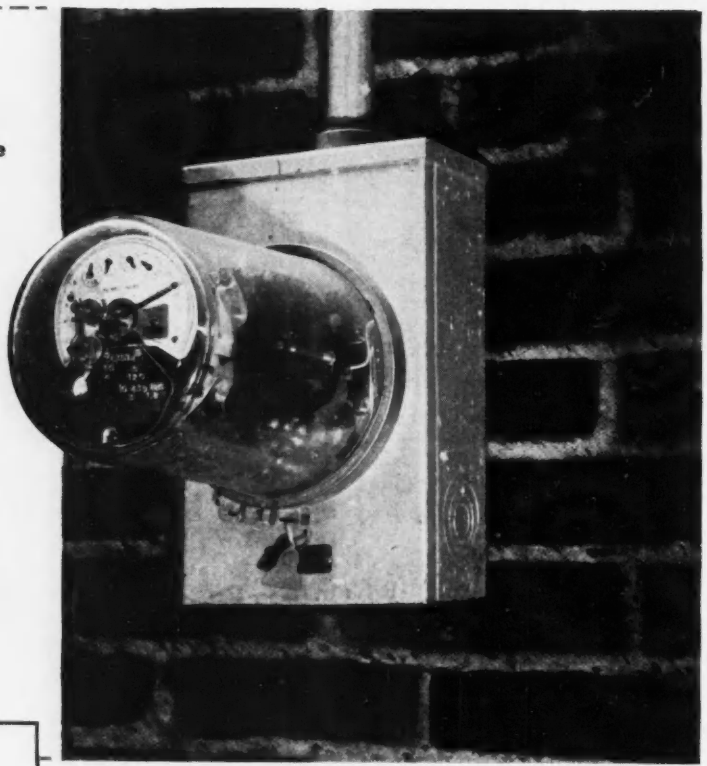
Write for your copies of Descriptive Bulletins No. 311 and 321, and for Service Manual No. 390.



Type JH
Singlephase



Type LCH
Polyphase



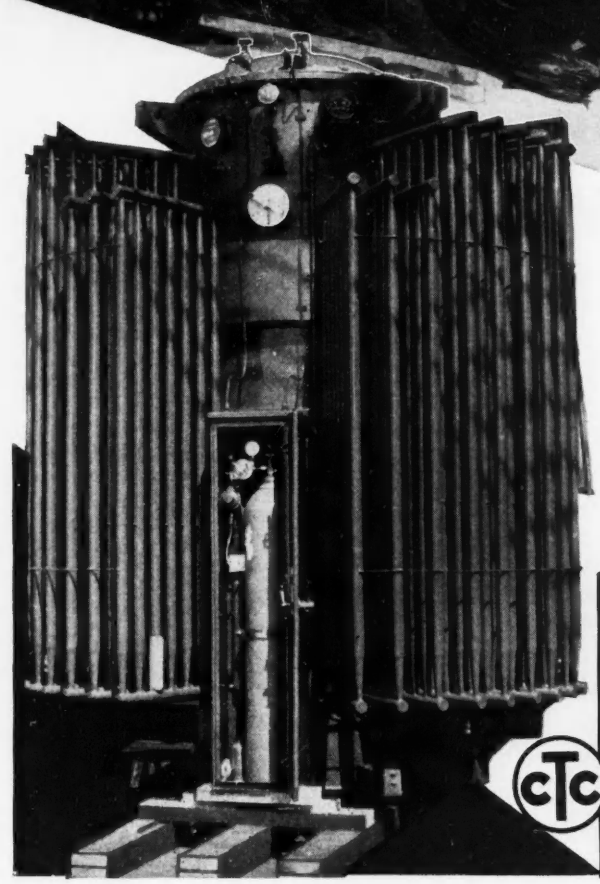
SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Only Measured Facts are Known Facts

SM53-8R

TRANSFORMERS?

Central!



Leafing process
on a Central 5000 KVA
Transformer

A Type for Every Need

Oil- or askarel-immersed transformers to 15000 KVA. Three phase, class "B" dry type transformers to 2500 KVA three phase. Shown at left is one of 8 recently-built 5000 KVA units.

Designed to Eliminate Radio Interference

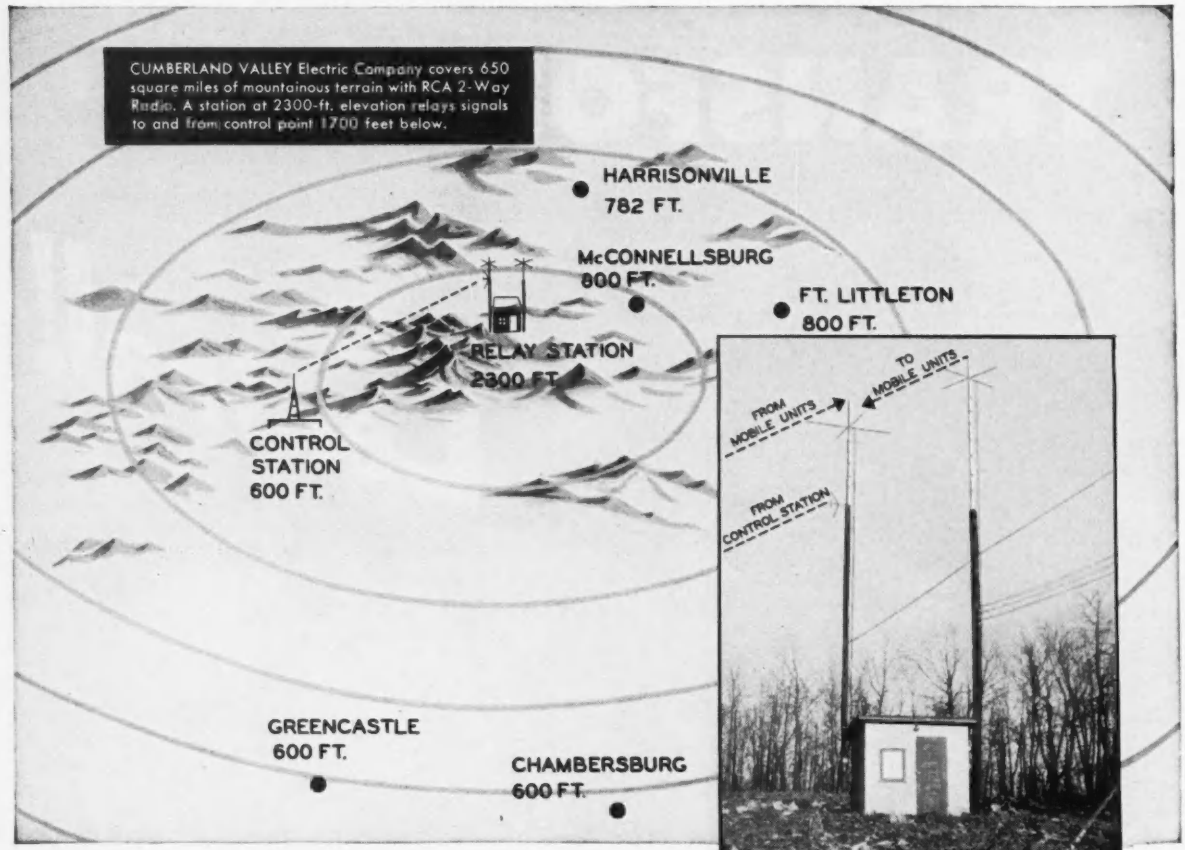
NEMA
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
MEMBER

CTC

Central

PINE BLUFF, ARKANSAS

SALES OFFICES IN PRINCIPAL CITIES



HILLTOP RELAY STATION receives signals from control station on 73.98 mc. and from mobile units on 48.54 mc. Station transmits on 37.58 mc.

RCA 2-Way Radio raises Cumberland Valley 1700 feet

VHF radio relay has recently converted a difficult piece of terrain into ideal radio territory for Cumberland Valley Electric Company, of Mercersburg, Pennsylvania.

Working with RCA communications men, Cumberland Valley engineers virtually lifted the utility's headquarters from its valley site, and placed it on a hilltop seven miles away. From this vantage point the company achieves unusual efficiency, over its 650 square-mile service area.

In addition, the installation permits twenty-four-hour communication between mobile units without requiring a twenty-four-hour dispatcher. Superior car-to-car communication, provided by the hilltop relay, keeps crews in direct contact with each other during dispatcher's off-duty hours.

For engineering assistance on difficult communications problems, contact the RCA Communications Specialist at your local RCA Regional Office. For day-in, day-out dependability, specify RCA 2-Way Radio. For Literature... clip coupon below, and mail it today.

RCA®

RADIO CORPORATION of AMERICA
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

Radio Corporation of America
Communications Equipment, Dept. 45WC
Building 15-1, Camden, New Jersey

☐ Please send me information on RCA 2-Way Radio.

☐ Please have an RCA Communications Specialist call on me.

Name_____ Title_____

Company_____ Address_____

City_____ Zone____ State_____

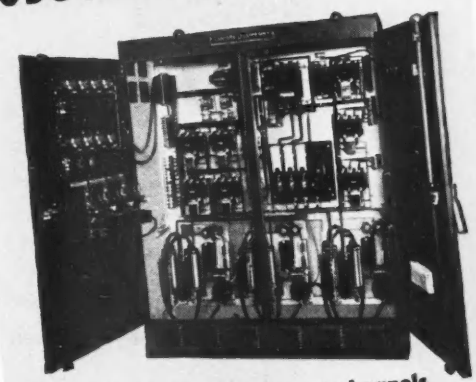
DESIGN LEADERSHIP

IN WELDER CONTROL FOR MASS PRODUCTION INDUSTRIES

A leading automobile manufacturer asked Square D to design magnetic and electronic control for a battery of 10 new multi-transformer welding presses. As many as 168 spot welds are made by one machine with 14 individually controlled timing periods in sequence.

Among the "must" requirements were:—welding current flow synchronized to prevent high starting transients and minimize stress on transformer windings; and a limitation of 1000 ampere current in each 3 phase line. *These 10 controllers are still providing trouble-free service after two years on the production line.*

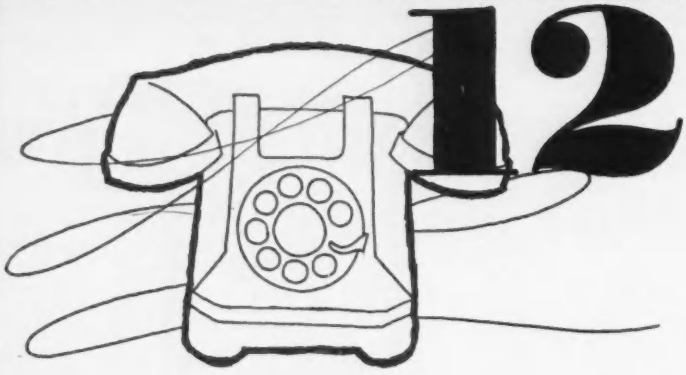
Engineering counsel on any electrical control problem is available through Square D field offices in all principal cities.



One of the completed control panels *Because Square D's line of control is so complete, this entire unit was designed using only standard devices, accessories and electronic sub-assemblies.*

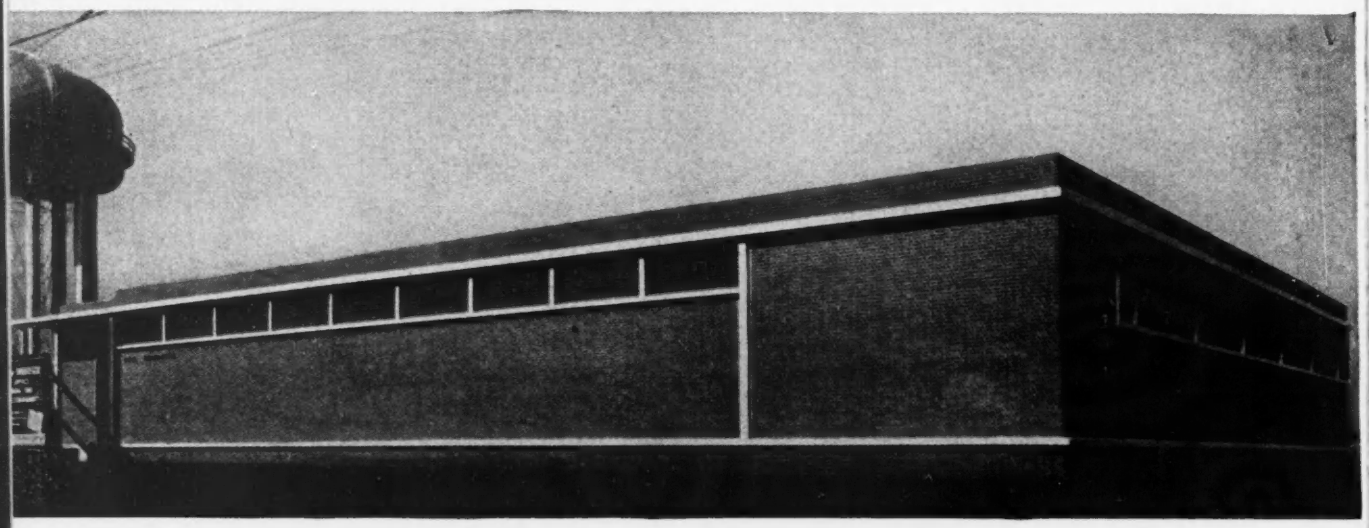
SQUARE D COMPANY

1903 • 50 YEARS OF DESIGN LEADERSHIP • 1953



12 KUHLMAN

help bring new subscribers



Beautiful, modern building of the new Windsor exchange of The Bell Telephone Company of Pennsylvania in the lower Delaware Valley near Philadelphia, Pennsylvania.

Over the past five years, Kuhlman Electric Company has furnished twelve Unit Substation Transformers to new exchanges and central offices of The Bell Telephone Company of Pennsylvania in the Delaware Valley, bringing service to many thousands of new subscribers. One of these twelve transformers, a 300 KVA, three-phase, STK unit, installed in the new $1,150,000 Windsor exchange, will eventually serve 20,000 subscribers in the lower Delaware Valley where U. S. Steel's sprawling Fairless Plant has created an industrial boom, unprecedented in recent years.

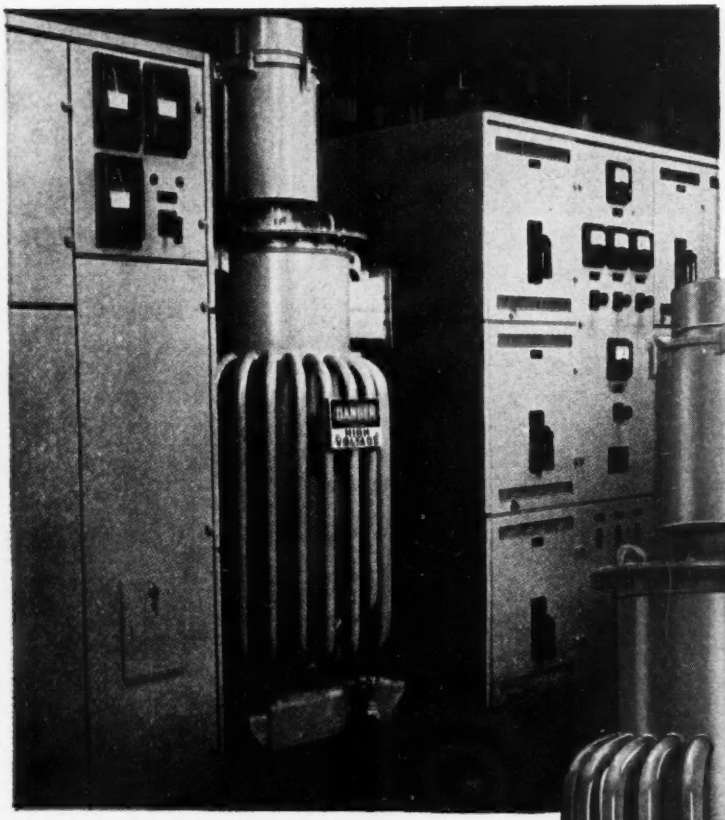
The selection of Kuhlman Substation Transformers for these installations will help insure regular, uninterrupted service to the new subscribers and provide efficient, low-cost operation for the telephone company.

Kuhlman Transformers are specifically engineered to the requirements of industries and utilities. Incorporating many advanced technical features developed and perfected by Kuhlman, they are built from carefully selected materials and assembled by men with many years of experience in the electrical crafts. Before delivery, they are thoroughly inspected and given all required ASA tests. Rugged construction and simplicity of design is the key to their safe, dependable performance and extremely long service with a minimum of attention. Kuhlman manufactures Power, Distribution, Dry-Type, Safe-T-Kuhl, Subway, CSP and Series Street Lighting Transformers. For complete information about any of these units, write us today.

Kuhlman **ELECTRIC COMPANY**

TRANSFORMERS

telephone service to thousands of in the Delaware Valley

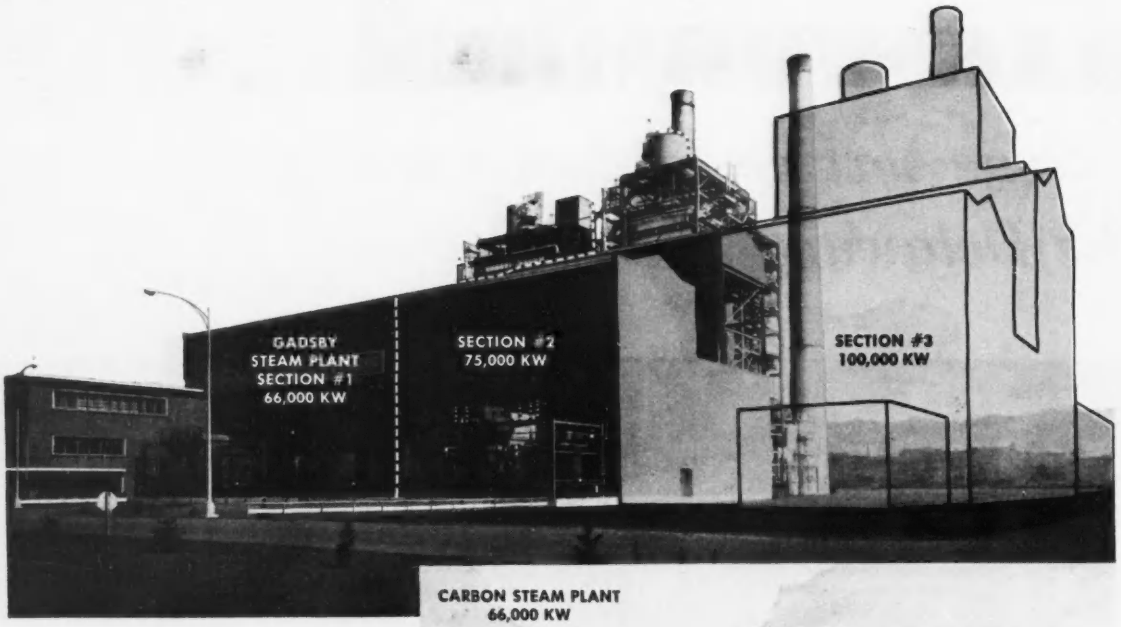


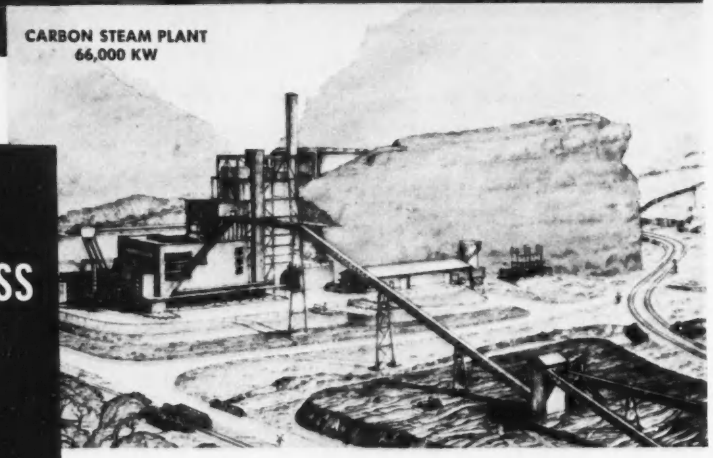
Left: The Kuhlman Substation Transformer installed in the Windsor exchange. Moody and Hutchison of Philadelphia were consulting engineers on the Windsor project. The switchgear was supplied by Pringle Electrical Manufacturing Company of Philadelphia, and the electrical contractor was H. B. Frazer Company of Philadelphia.

Below: The Kuhlman Substation Transformer with throats ready for shipment to The Bell Telephone Company of Pennsylvania for installation in the new Windsor exchange. The transformer has been fully inspected, and rigorous operating tests have been run. Kuhlman also makes flush end design substation transformers.

BAY CITY, MICHIGAN • SOUTHERN DIVISION • CRYSTAL SPRINGS, MISSISSIPPI

EXPORT REPRESENTATIVES: *International Standard Electric Corporation,*
67 Broad Street, New York 4, N. Y. Cable Address, Microphone, N. Y.





Utah Power measures progress in kilowatts

An important factor in the post-war industrial progress of the Beehive State is the growth of its available electric power. When a utility adds to generating capacity in advance of demand, it must formulate complex plans and make large scale commitments years ahead of actual need.

Decisions of this magnitude require foresight and courage, qualities characteristic of the management of Utah Power & Light Company. Key units in its program are the 240,000 kilowatt Gadsby Steam Plant at Salt Lake City, built in three stages, and the 66,000 kilowatt Carbon Steam Plant at Castle Gate.

BECHTEL CORPORATION

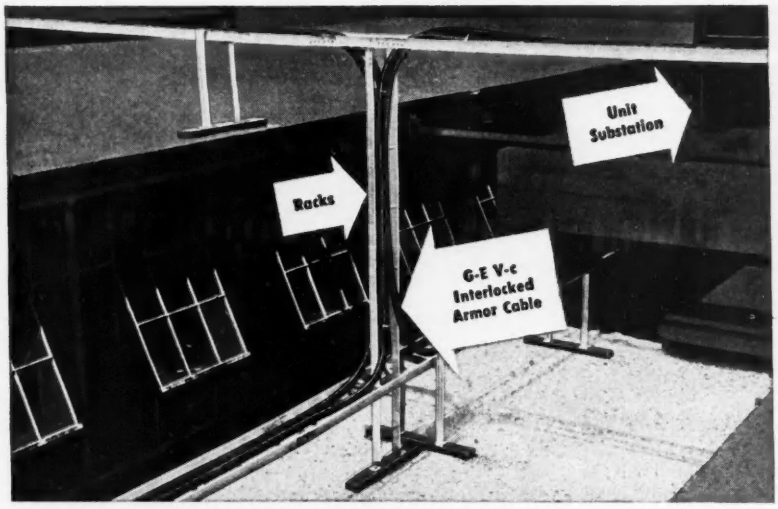
Los Angeles • **SAN FRANCISCO** • *New York*

BECHTEL

BUILDERS FOR INDUSTRY

Originally retained in March 1949 to design and construct the first Gadsby unit, Bechtel Corporation was awarded unit two in September 1950, the Carbon plant in March 1953, and Gadsby unit three in July 1953. Repeat business—in multiples—is a reliable indication of the quality of an engineer-constructor's performance.

Broken roof lines present no problem for the G-E V-c interlocked armor cable system



The G-E V-c interlocked armor cable system can be quickly installed by utilizing existing structures. This feature saves time and has helped many plants to maintain production during installation.

Installation speed important feature

To distribute power in a modernized plant, an eastern manufacturer used 12 G-E unit substations on the roof and then installed a G-E V-c interlocked armor cable system to bring high-voltage power to these substations. More than a mile of G-E V-c interlocked armor cable was used. The cable was 3-conductor #2/0, 15,000-volt, No. 1799 varnished-cambric-insulated with an over-all thermoplastic jacket and bronze armor.

Easier installation

The uneven contour of the buildings' roofs made an ordinary conduit installation extremely difficult. And underground duct work would have meant costly tearing up of concrete floors. Either of these methods also meant more installation time and more cost for materials.

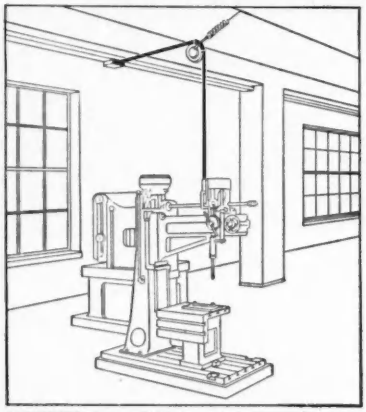
Racks used

Aluminum racks, only 12 inches wide, were used to carry the cable over the many rises, slopes, and bends on the roofs. Because the G-E V-c interlocked armor cable system is light and flexible, no difficulty was experienced in pulling long lengths by hand.

Readily available

G-E V-c interlocked armor cable on racks is always open for visual inspection — always accessible — quickly spliced with simple, mechanical joints. To our knowledge, no installation of G-E V-c interlocked armor cable has ever suffered mechanical damage sufficient to cause electrical failure.

For fast connections to plug-in type overhead buses



G-E Flamenol* bus-drop cable provides a fast, easy way to connect machine tools to low-voltage, overhead, plug-in type distribution buses. No conduit is needed. The cable is inserted into inexpensive watertight connectors at the bus and at the machine tool switchboard, and is supported by a cable loop as shown at the left.

The insulation and jacket on Flamenol bus-drop cable resist oil, grease, gasoline, acids, and alkali cutting fluids. This cable withstands severe mechanical abuse, and will not support combustion.

G-E Super Coronol cable passes 5½ year, 121 C test

Aging tests of G-E Super Coronol* cable held continuously under load at 121 C copper temperature have passed the 5½-year mark. This remarkable cable shows no sign of deterioration with both physical and electrical properties remaining stable after the 20th month. The tests are continuing and have enabled G. E. to raise the maximum rating of Super Coronol cable to 85 C copper temperature up to 8000 volts—80 C above 8000 volts.

HOW TO CHOOSE HEAT-RESISTANT WIRE AND CABLE

G. E. has prepared a useful booklet as an aid in the selection of Deltabeston* power cables, Types AVA, AVB, AVL. The booklet is free — Pub. No. 19-269-1.

*Registered Trade-mark General Electric Company

The next time you have a question on cable, call a G-E wire and cable specialist for prompt, expert help. You can reach him at the nearest G-E Construction Materials district office. Or, write Section W76-1127 Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

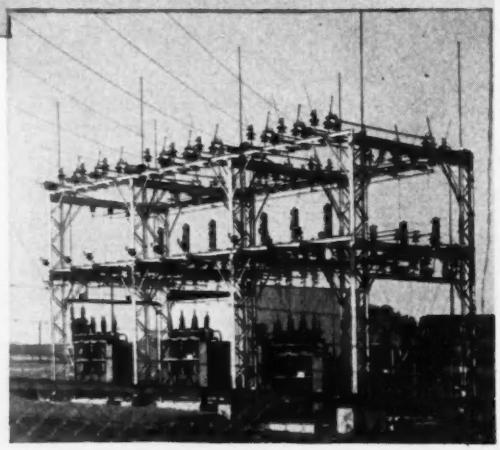
You can put your confidence in—

GENERAL ELECTRIC

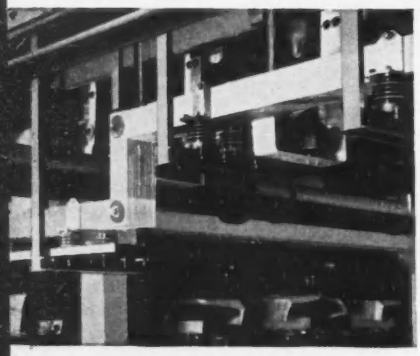
From Incoming POWER to Operating POWER

Complete Electrical Distribution Equipment for Electrochemical and Electrothermal Industries

Four cooperating I-T-E Divisions provide unified, coordinated service. One order; one responsibility; simplified planning; easiest installation.

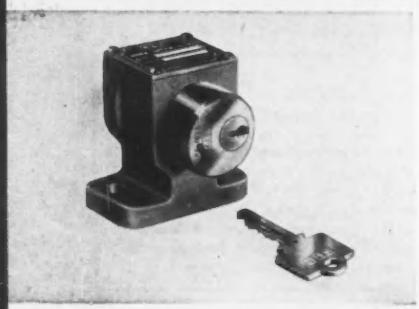


R&IE EQUIPMENT



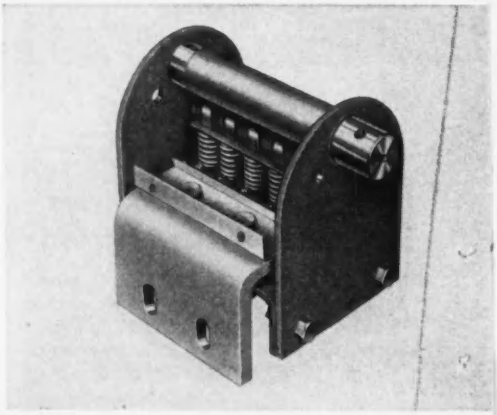
For incoming power—SWITCHING EQUIPMENT and SUPPORTING STRUCTURES. Complete design and fabrication for bus supports, air switches, cutouts, and supporting structure.

For power feed to cells or furnaces—BUS DESIGN and FABRICATION. Engineering service, detailing, and complete fabrication. Ready to install.

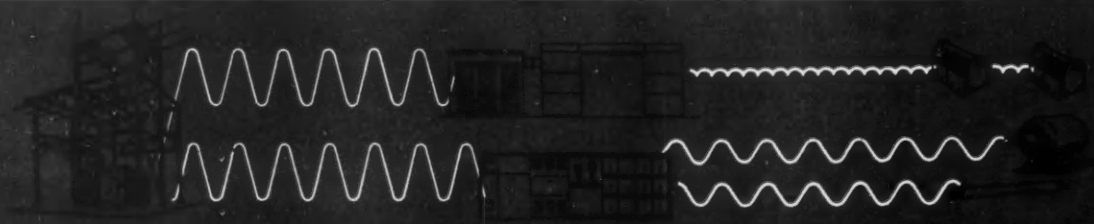


For shorting cells or other equipment—HIGH-CURRENT DISCONNECTING SWITCHES. Economical, space-saving switch applications for chemical or thermal processes.

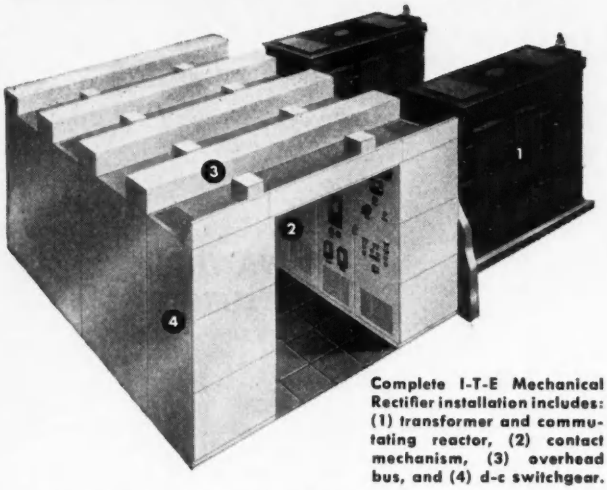
For protection of men and equipment—KIRK KEY INTERLOCK SYSTEMS. Prevent the authorized operator from performing an unauthorized operation.



Call the nearest I-T-E Field Engineer for complete service with Power Distribution and Power Switching Equipment.



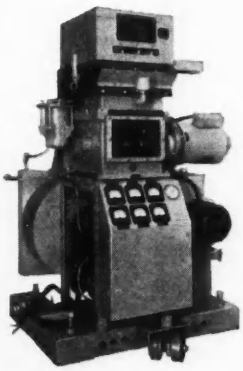
MECHANICAL RECTIFIERS



Complete I-T-E Mechanical Rectifier installation includes: (1) transformer and commutating reactor, (2) contact mechanism, (3) overhead bus, and (4) d-c switchgear.

For d-c supply—I-T-E Mechanical Rectifiers have operating efficiency of 94% to 97%, including all components from a-c line to d-c bus. High efficiency is maintained from 25% to 125% of rated load current.

These rectifiers are an excellent source of savings on power costs. Their design saves space. Installation is simple. No special building construction or cranes are required.

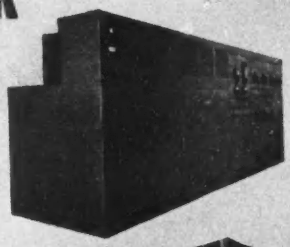


5,000-ampere contact mechanism. Multiple 5,000 and 10,000 ampere mechanisms are operable in parallel.

SWITCHGEAR

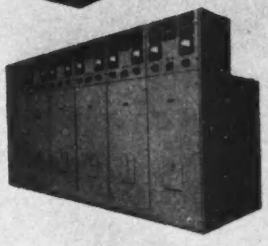
Unit Substations

For applications requiring primary or secondary types; indoor or outdoor installation; oil, askarel, or air transformers. Switchgear is of I-T-E metal-enclosed construction with drawout-mounted air circuit breakers.



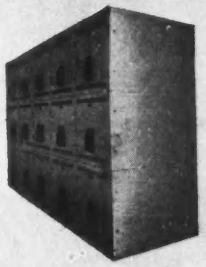
Metal-Clad Switchgear

For reliable protection, based on proved interrupting capacity, I-T-E provides factory-assembled and -tested switchgear, shipped as a unit, ready for low-cost installation. I-T-E air circuit breakers are horizontal-drawout mounted, featuring simplified disconnect and test with doors closed.



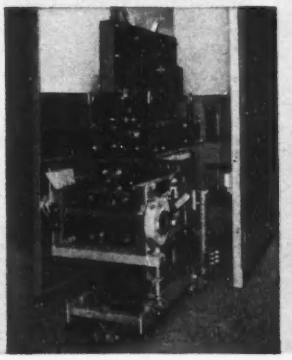
Low-Voltage Switchgear

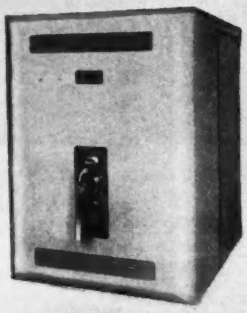
For reliability and long life with reduced maintenance, I-T-E has metal-enclosed switchgear featuring pantograph, drawout air circuit breakers with complete range of ratings and widest selection of protective devices. Structures are exceptionally rugged and durably finished.



D-C Circuit Breakers

For interrupting heavy direct currents, as for protection of rotating machines and rectifiers, I-T-E provides specially-developed circuit breakers combining very rugged construction with fast circuit-opening and reliable arc extinction. Available auxiliary devices make these circuit breakers widely applicable.



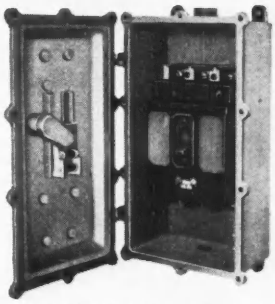


Pullbox-mounted Urelite with all live parts enclosed for safety and dependable performance.

AIR CIRCUIT BREAKERS

LARGE and SMALL

For low-voltage applications, I-T-E offers a wide range of frame sizes, ratings, and tripping arrangements. Individually enclosed large air circuit breakers (Urelites) have the widest selection of trip devices and accessories. Molded case circuit breakers, available in four frame sizes, have dust-tight, vapor-tight, moisture-proof, or explosion-proof enclosures. All breakers are designed for easy application, accessibility, and trouble-free operation.



Molded Case Circuit Breaker in approved explosion-proof enclosure.

I-T-E CIRCUIT BREAKER COMPANY

Power Switching and Distribution Equipment

Circuit Breaker, Switchgear, and Rectifier Divisions, Philadelphia 30, Pa.

R&IE Equipment Division, Greensburg, Pa.

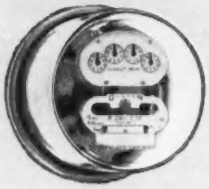
For Your METERING REQUIREMENTS

HD DEVICES

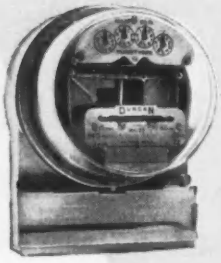
SOCKETS

MOUNTING DEVICES

SINGLEPHASE WATTHOUR METERS

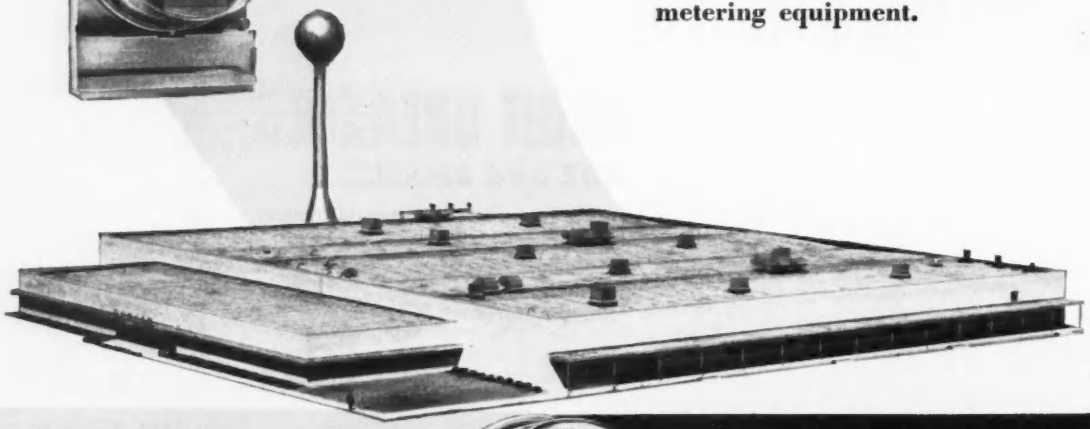


DEMAND METERS



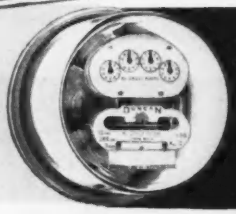
POLYPHASE WATTHOUR METERS

DUNCAN'S more than half-century of engineering and production *know how*—operating in modern plant facilities—is your guarantee of sound watthour meters and metering equipment.



DUNCAN

WATTHOUR METERS



Aerial view of new Duncan Plant. Completely air conditioned—modern in every respect.

DUNCAN ELECTRIC MFG. CO.

LAFAYETTE, INDIANA

ANACONDA FORUM
for the Electrical Industry

ELECTRICITY FOR BETTER LIVING

by M. E. Skinner,
Vice President and Director of Sales,
Union Electric Company of Missouri,
St. Louis, Missouri

EVERYONE connected with the electrical industry has an obligation to exert some effort continuously to expand the future market for electrical goods and services.

There are many ways of carrying on such a program, but I know of none more basic and constructive than the promotion of more Adequate Wiring.

Notice I said *More* Adequate Wiring, for there never was and probably never will be a house that could permanently qualify as adequately wired.

NEW USES FOR ELECTRICITY

We must recognize that new uses for electricity are developing at an amazing rate and that public acceptance of the electrical way of life is steadily increasing the demands placed upon the wiring system in every American house.

Most of the things that electricity does for us cannot be done satisfactorily, or in many cases at all, with any substitute form of energy. For example, you cannot enjoy a television show except with the help of electricity. As a result, I am sure that no television receivers remain unsold because of inadequate wiring.

However, many thousands of homes are not enjoying their television as they should because of inadequate wiring. People in these homes obtain mediocre performance from their sets and are unable to do other things at the same time the set is on because a lamp or some other appliance has to be unplugged to make way for TV.

INADEQUATE WIRING MEANS LOST SALES

In the case of appliances whose function can be performed by some other form of energy, such as gas, our electrical industry is paying a heavy penalty in lost sales opportunities because of inadequate wiring.

We all know how difficult it is to portray these future possible uses of electricity—to a customer who is not now enjoying them—with sufficient force and reality to convince him, when he builds or buys a new home, of the necessity of investing now in sufficient copper, convenient outlets and switches to provide for the inevitable future which lies before him.

Maybe we never can, but we should be able to convince him of the importance of a basic foundation which will enable him to add to and expand his wiring as the need develops without tearing the house apart and starting over.

REQUIREMENTS FOR GOOD WIRING

Entrance capacity to provide for future needs, availability of 230 volts at the panel for future additions of heavy-duty appliances, enough circuits so that there is some room to grow, a distribution center from which additional circuits can be readily taken off, and copper large enough so that you don't blow a fuse every time you start a room cooler —these are the foundations for a wiring system that can be adequate today and can be kept up-to-date as we progress toward Better Living Electrically.

MONSANTO ENGINEER OUTLINES PROGRAM FOR KEEPING INDUSTRIAL POWER FLOWING

ON THE NEXT PAGE, Charles E. Knight plant engineer since 1948 for the Springfield, Mass. headquarters of Monsanto Chemical Company's Plastics Division, discusses the details of a well-rounded maintenance program for industry. Hard-working, likable, Mr. Knight has risen in only a decade with Monsanto from draftsman to his present important position. He was graduated from Mass. Institute of Technology in 1926, with a B.S. degree in mechanical engineering.

MAINTAINING

Electric power is a basic making the distribution

by C. E. Knight

PLANT MAINTENANCE and electrical engineering officials are best qualified to counsel management on present and future electric power needs.

ELECTRICAL power is one of the most important raw materials in modern industry, particularly since its use and distribution is not limited to a few departments, but is plantwide. As a result, an interruption in the delivery of this important raw material to any department can cause a major interruption of production. Enlightened plant management recognizes this fact and emphasizes the proper management of the organization charged with the responsibility for providing and distributing electrical power. This responsibility is normally assigned to a utilities group which is a unit of the Plant Engineering department. Regardless of the organizational position of the utilities group, it is essential that they be completely familiar with and consulted on any policy changes that effect changes in the use of electricity. Sales forecasts and long range expansion plans should be available for predicting loads.

The responsibilities of the Utilities Group are, in a broad sense, to provide the necessary electric power where needed throughout the plant; to be prepared, when an interruption occurs, to re-establish the supply by immediate repair of deranged equipment or use of auxiliary equipment; to keep informed of long-term planning as it affects requirements for electric power, transformers and distribution equipment and take timely steps to fulfill increased demands.

FUNCTIONS OF UTILITIES GROUP IN PLANT ENGINEERING

In discharging this responsibility, the functions of the Utilities Group are divided into four major categories (1) Routine Maintenance (2) Preventive Maintenance (3) Preventive Engineering and (4) Long Range Planning. Because there is considerable overlap in these categories, a brief discussion of each phase may be helpful.

(1) ROUTINE AND BREAKDOWN MAINTENANCE

This is the normal daily repair work that must be done, including major repairs resulting from breakdowns. Prerequisites for adequate coverage here are: complete drawing files; specifications for all transformers and distribution systems; a trained group of electricians completely familiar with electrical equipment and distribution systems; an adequate supply of spare parts.

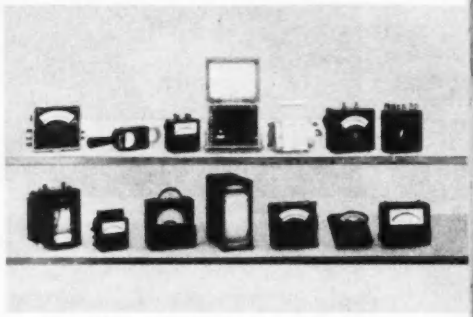
(2) PREVENTIVE MAINTENANCE

The elements of a sound preventive maintenance program are familiar to all. It is essential that this program be carried out in an orderly manner and that the responsibility for its continuation be fixed. Check lists and periodic reports are a "must." These should include such things as visual inspection of poles, insulators, manholes, condition of contacts in switch gear; filtering of transformer oil; checking relay performance by test tripping; megging feeders to determine insulation conditions; inspection of switch rooms for physical condition and cleanliness.

The installation of either meter mounts or installed meters for checking loads on critical feeder lines directs attention to overloading and will help prevent voltage loss, excessive heating and attendant insulation breakdown.

Periodic adjustment or replacement of equipment, based on failure frequency reflected in the Repair History (part of the preventive maintenance program) will go a long way toward reducing costly, unexpected breakdowns.

Where continuous operation, such as is found in the petroleum and chemical industries, makes arbitrary maintenance shutdowns financially unattractive, these inspections, replacements and adjustments must be integrated into a flexible program that can be put in motion whenever production schedules or operating emergencies dictate a shutdown.



INSTRUMENTS UNCOVER electrical system deterioration and obsolescence. The number required varies with system complexity. Here are a few used by industrial service firms.

(3) PREVENTIVE ENGINEERING

One of the most effective means of avoiding interruption of electrical service is the engineering of each change or addition to reduce the possibility of breakdown. Not only should new installations be so engineered but existing installations must be continuously studied in the light of experience and changing conditions to minimize the chance of failure. This function is one of the important duties of the Electrical Engineering group. In the location of feeders and distribution lines, such

FULL ELECTRIC POWER IN INDUSTRY TODAY

raw material for *all* industries. Here's a sensible program for system safe, adequate and less liable to costly breakdowns.

Plant engineer at the Springfield, Mass. headquarters of Monsanto Chemical Company's Plastics Division

factors as the corrosive qualities of the soil (or the vulnerability of overhead lines), location of future buildings, and probability of increased demand must be considered. The type of insulation used on feeder lines should depend upon local conditions.

IF YOU ARE INTERESTED IN REPRINTS of this issue of the ANACONDA Forum, see your Anaconda Representative... or write to *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

Since most electrical distribution equipment has a relatively long life and is less subject to obsolescence than manufacturing equipment, it is generally good management to use the highest quality equipment obtainable. A few dollars saved may be wasted many times over as a result of a service interruption. Choice of cable is a practical example of this, since the cost of a cable failure, considering downtime and replacement, will probably nullify the "saving" realized in an installation of inferior quality.

Standardization in the design of distribution systems and switch gear reduces the spare-part inventory and can result in substantial savings during alterations. The use of several transformer stations, each protected with suitable interrupting switches, tends to localize emergencies. These are but a few of the ways in which a qualified electrical engineering staff can and must aid in insuring uninterrupted supply of electrical power.

(4) LONG RANGE PLANNING

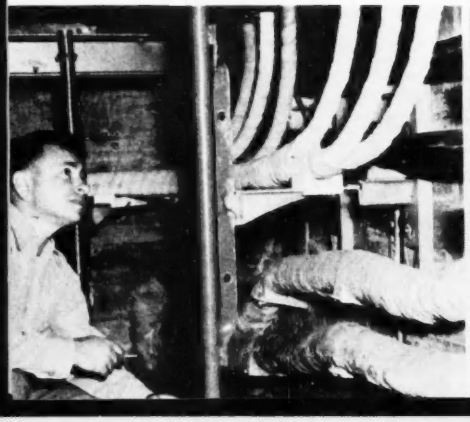
It is in this field that a plant's electrical engineering group must function as an integral part of plant management and be a part of the policy-making group where production operations and their power requirements are concerned. Forecasts of power requirements based on sales forecasts and long range expansion plans must be established and revised periodically to provide the hypothesis for engineering studies of modifications to meet anticipated needs.

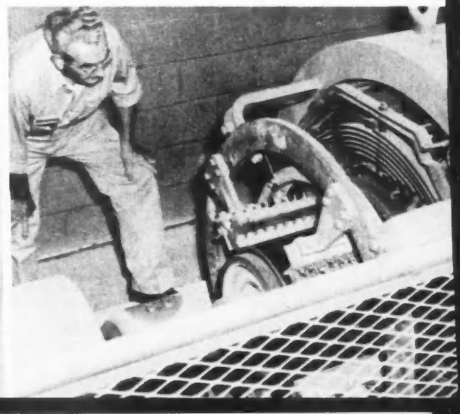
This approach avoids the frequent difficulty of a distribution system growing "like Topsy," which eventually necessitates a complete and costly replacement of the entire system or inefficient use of existing equipment. Any modifications or additions to the existing system are made to allow for future requirements. The installation of manholes or feeder ducts can be made with provision for additional capacity when needed. Switch rooms and sub-stations are built so that they are of sufficient capacity or can be enlarged to handle future needs. Although electrical distribution equipment has a relatively long life, it is often made prematurely obsolete by plant expansion. The above approach can tend to minimize this problem.

LOAD TESTS frequently uncover mechanical defects that overload motors and cause failure.

(—*continued on next page*)

PREVENTING COSTLY SHUTDOWNS. At Monsanto Chemical Co. inspection plays a big role in keeping power flowing. Here electricians regularly inspect such vital parts of the system as the distribution lines in a power tunnel and the main primary breakers in a substation. Even the brushes on a 700 hp. motor-generator are checked.





(—KNIGHT, Continued)

KNOW YOUR UTILITY, CONTRACTOR AND EQUIPMENT SUPPLIER

Woven through the entire program for providing uninterrupted distribution of electrical power, both for current operations and for future expansion, must be the relations with the utilities company, the electrical contractor and electrical equipment supplier. In spite of the best-laid plans, emergencies will occur during which the services of any or all of these can be invaluable. In long range planning, their experience and knowledge of factors not a part of plant operation can frequently aid in formulating a more sound program. It is important that the plant electrical engineering group establish and maintain friendly relations with these organizations.

WHAT UNINTERRUPTED ELECTRIC SERVICE REQUIRES

In summary, the importance to the plant, of an electrical distribution system that is adequate, safe and maintained so as to avoid any interruption of power distribution cannot be over-emphasized. Providing this service requires: a staff of technically trained electrical engineers; an electrical shop with adequate tools and staffed with competent electricians thoroughly familiar with the system; a serious preventive maintenance program; a reliable supply of electrical equipment and cable both in the plant and/or available through a distributor; close liaison with top management on major fluctuations in or expansions to production activity. Integration of these points into a well-formulated program will produce the desired result.

ANACONDA REVIVES INDUSTRY-WIDE PROGRAM TO "POWER-UP— AND BE PREPARED"

Aimed at large industrials, "POWER-UP—And Be Prepared" tells plant executives that NOW is the time to modernize their plant wiring systems.

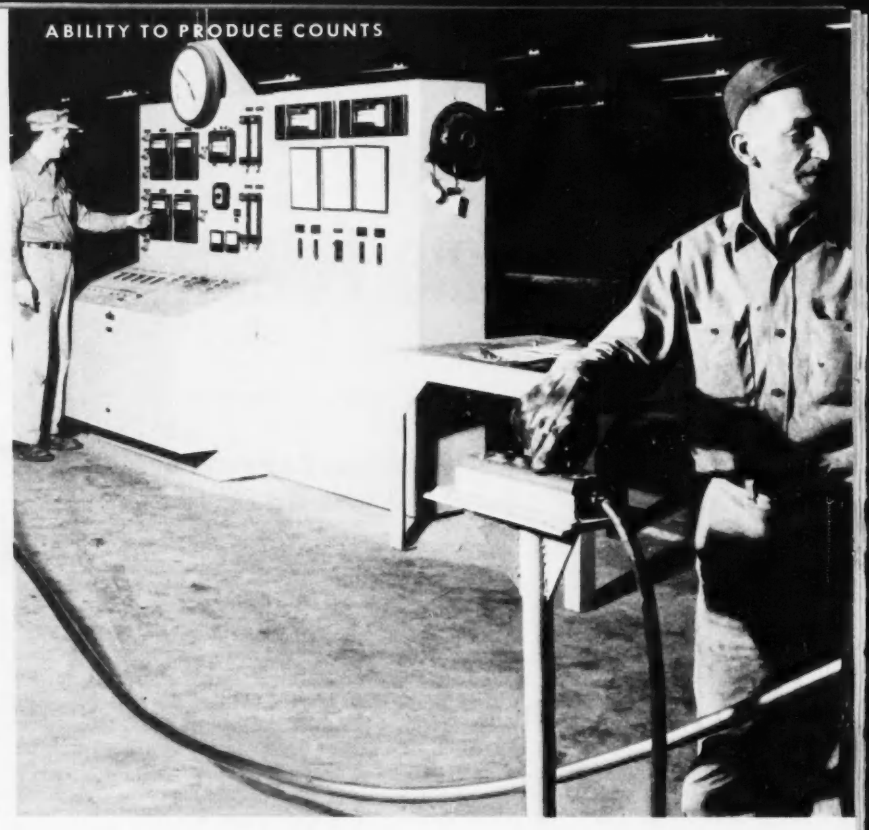
Utilities, contractors and distributors are being asked to cooperate in this program. Everybody benefits . . . when everybody ties in.

See your Anaconda Sales Office or Distributor now for full details and free promotion material.

New "Full Power Ahead" Campaign Sells Wiring Modernization to

- **farms**
- **small industrials**
- **homes**
- **commercial enterprises**

The new FULL POWER AHEAD Program means new business for contractors and distributors . . . increased power sales for utilities. Anaconda has prepared a complete tool kit of promotion material to help you get your share of today's MULTI-BILLION dollar wiring modernization market. For more information write Anaconda Wire & Cable Company today. 53385



Now he pushes a button

. . . and turns out a *better* cable faster

Old-time cable men—and younger ones, too—whistle when they watch this new lead-extruder at work at Anaconda. You touch a button . . . keep an eye on the instrument panel . . . and the cable rolls on the reel, ready to use. You don't stop for refills. This extruder works continuously.

It's a big gadget . . . and a *better* one for two reasons. It speeds up service to our customers. And it assures them of a quality product, more uniform than ever before. It's one more example of the modern methods Anaconda uses to give you better cables and cable accessories, made to standards that usually top recognized industry specifications.

In mills and mines, we've put our dollars to work in a vast program of improvement and expansion. It has three objectives:

1. *delivery of products in ample quantity to meet industry's needs.*
2. *development of new products to meet new needs or to meet old needs better.*
3. *quality consistently maintained through an exacting program of statistical control.*

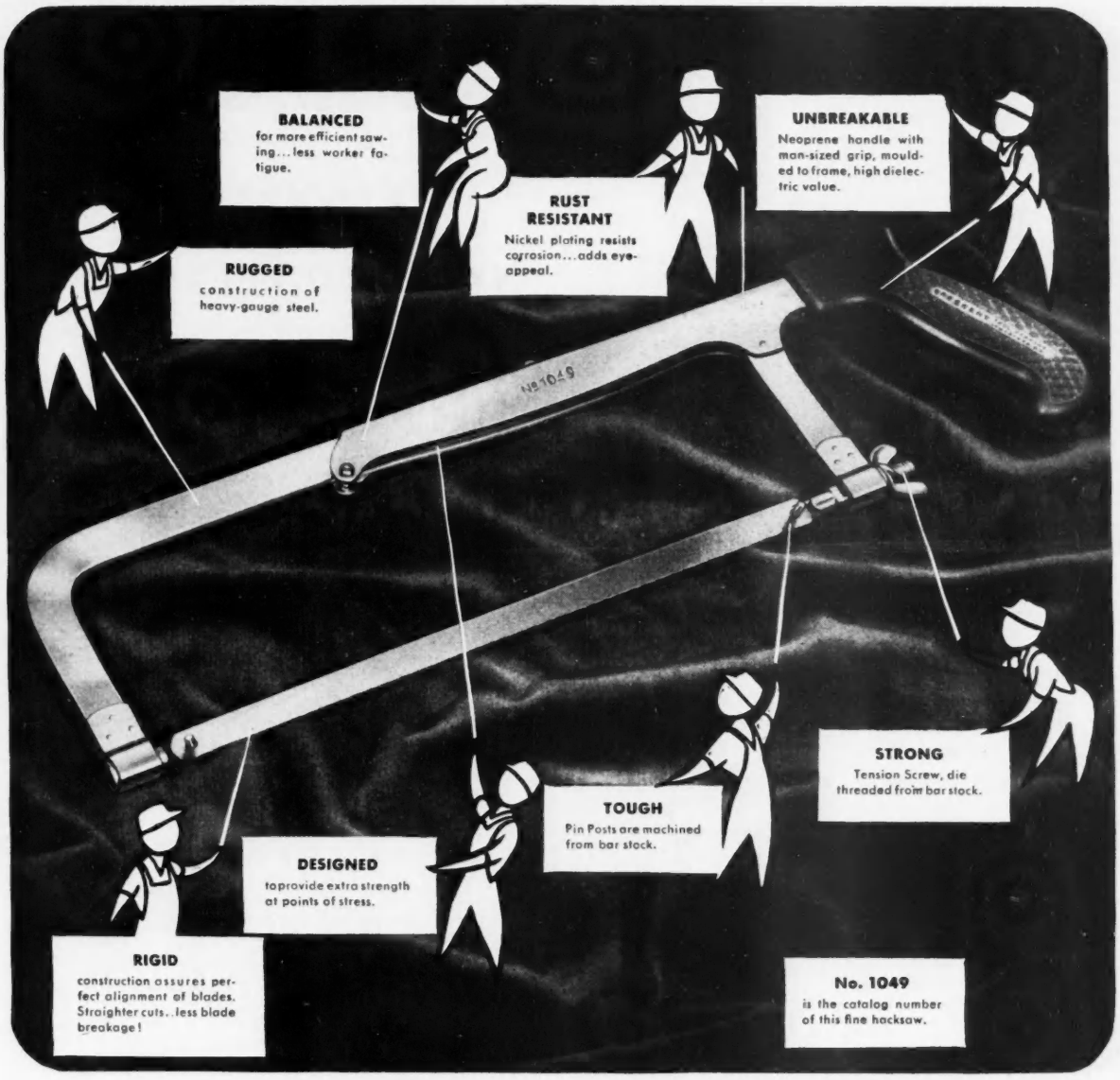
Look at it from your side of the desk. You get better products, delivered faster, and lasting longer *when you specify* ANACONDA.

Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

ANACONDA®

TODAY'S HEADQUARTERS FOR WIRE AND CABLE

MAKERS OF building, barn, machine tool, control and communication wire • service and overhead distribution cables, bare and weatherproof including ACSR • portable cords and cables • power and busdrop cables • mine, bridge, aerial, underground, duct, network and submarine cables • parkway, airport and street-lighting cables • station, apparatus and vertical-riser cables • magnet wire • copper, aluminum and copperweld conductors • wire and cable accessories.


BALANCED
for more efficient sawing... less worker fatigue.
RUST RESISTANT
Nickel plating resists corrosion... adds eye-appeal.
UNBREAKABLE
Neoprene handle with man-sized grip, moulded to frame, high dielectric value.
RUGGED
construction of heavy-gauge steel.
No 1049
STRONG
Tension Screw, die threaded from bar stock.
TOUGH
Pin Posts are machined from bar stock.
DESIGNED
to provide extra strength at points of stress.
RIGID
construction assures perfect alignment of blades. Straighter cuts.. less blade breakage!
No. 1049
is the catalog number of this fine hacksaw.

These eight features make Crescent's No. 1049

A BETTER HACKSAW

● In addition to its structural superiority, this fine Crescent Hacksaw has a neoprene handle... comfortable and resilient to grip... practically indestructible... impervious to oil, acids, extreme heat or cold. Sold by Hardware Dealers everywhere.

CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan
Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

Here's the
Simplest, Safest Way
to By-Pass
Voltage Regulators

the New Improved KEARNEY ONE PULL

CAT. NO. 10294-1
200 Amp. 7.5 KV

CLOSED TYPE . . . Available in 100 ampere 7.5 KV and 200 ampere 7.5 KV. Features: Wet process porcelain housing; Bakelite door; bus bar copper blades with ceramic spacers; heavy bronze terminals are plated for use with all types of line wire from No. 6 sol. to 2/0 str.; auxiliary arc extinguishing switch is optional equipment. Complete with hanger for all crossarms from 3¼" x 4¼" to 4" x 5". Surge protector should be used with this equipment.

- by-passes the regulator
- opens both regulator leads
- interrupts the exciting current

Specify KEARNEY

All Danger Eliminated

The fool-proof, automatic switching sequence of this new, improved KEARNEY By-Pass Disconnect Switch eliminates all danger of load dropping. Even more important, the exciting current is automatically interrupted for complete safety. This closely coordinated make-before-break design allows the regulator to be isolated without load disturbance or arcing at the contacts.

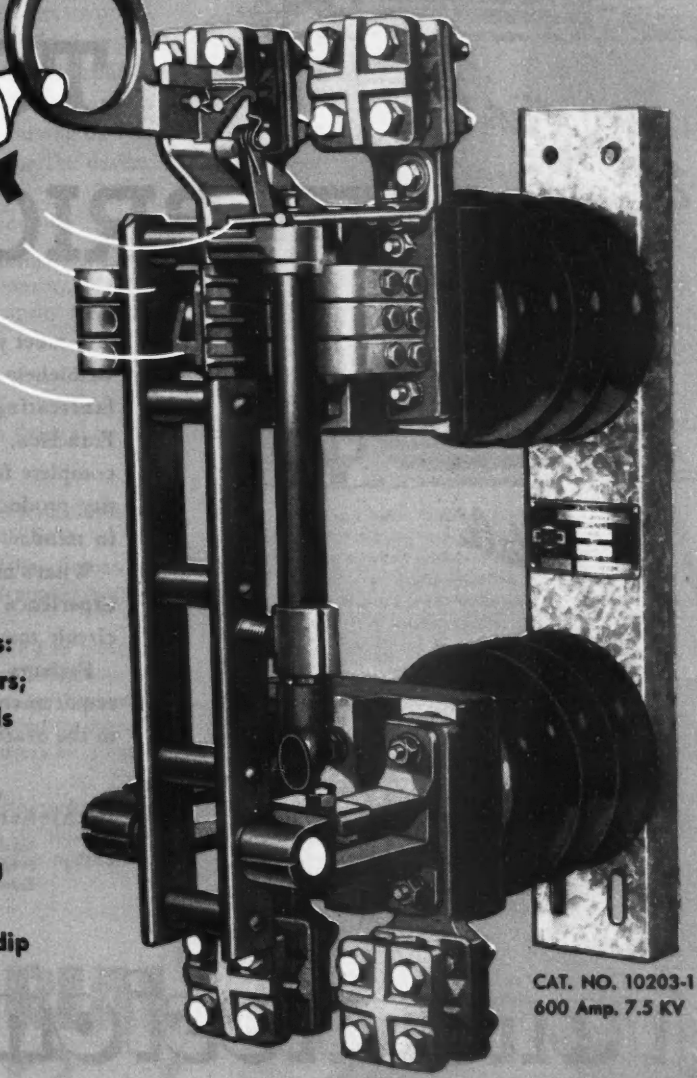
Naturally, you save money in construction with the improved KEARNEY By-Pass Disconnect Switch. It does the job that formerly required three disconnect switches. You save switchgear expense, installation costs and substation space.

for full information and prices ask your KEARNEY man, or write

JAMES R. KEARNEY CORPORATION
4224-42 CLAYTON AVE., ST. LOUIS 10, MISSOURI
Canadian Plant: Guelph, Ontario

BY-PASS DISCONNECT SWITCH AUTOMATICALLY

The Mark of JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *Quality Products*



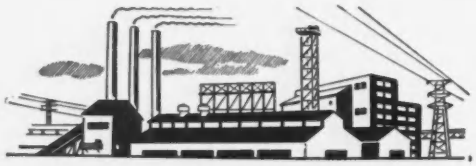
OPEN TYPE... Available in four current ratings: 200, 400, 600 and 1200 amperes. Voltage ratings: 7,500, 15,000. Precision construction throughout. Features: Bus bar copper blades with ceramic spacers; shoe type contacts; heavy bronze terminals are plated for all types of line wire from No. 4 sol. to ¾" IPS copper (1200 ampere model terminals are to customers' specifications); auxiliary arc extinguishing switch is optional equipment; 3-inch bolt circle insulators are NEMA standard; hot dip galvanized channel base. Surge protector should be used with this switch.

CAT. NO. 10203-1
600 Amp. 7.5 KV

PRODUCTS

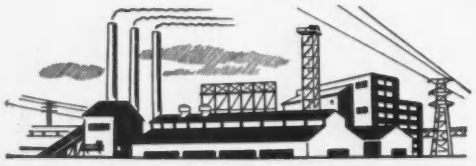
For Better Construction . . . Safer Maintenance

New L-M Manual Remote Control

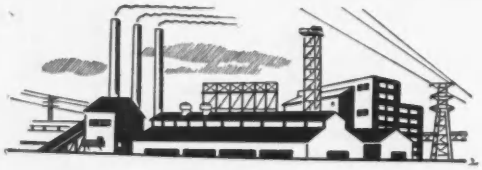


Seattle

3 SHOPS FOR TOWER FABRICATION



South San Francisco



Leetsdale

To meet your transmission-tower requirements, Bethlehem offers the services of three large tower-fabricating shops, at Seattle, Wash., South San Francisco, Calif., and Leetsdale, Pa. Each shop has complete fabricating facilities, and can handle quantity production of any type of tower you may have in mind.

What's more, our engineering staff has had years of experience in designing both single- and double-circuit towers for practically every load condition.

Perhaps you would like to talk over your tower requirements with a Bethlehem man. Just drop a line to the nearest Bethlehem office.

BETHLEHEM STEEL

Bethlehem Steel Company, Bethlehem, Pa.

On the Pacific Coast the fabrication of transmission towers is handled by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Transmission Towers

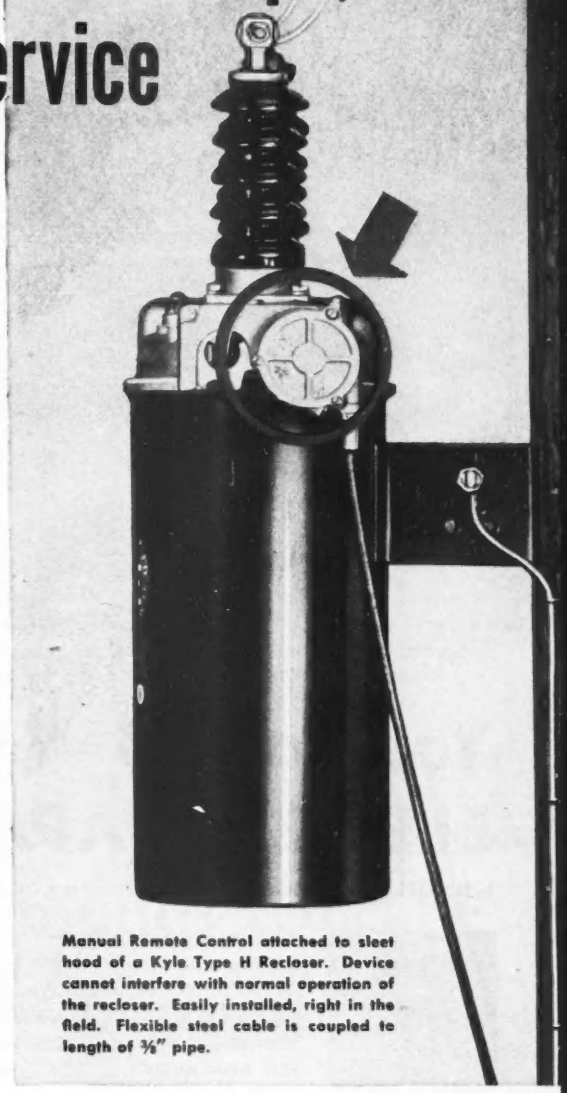
New L-M Manual Remote Control for Reclosers Saves Trouble Trips, Improves Customer Service

L-M's Remote Control for Kyle Type H Reclosers provides manual operation from the base of the pole. It eliminates the need for climbing the pole. No switch stick is needed. Anyone can be instructed to operate the device. The handle can be locked to prevent unauthorized operation.

Use of the device eliminates the need for sending a line crew to open or close a recloser. Farmers or property owners in remote locations can be provided with a key so that they can operate the control upon telephone instructions. This can be particularly valuable when roads are blocked by mud or snow. The saving on one service trip by a crew more than pays for the device.

Let Us Give You Complete Information

Ask the Line Material Field Engineer for details on the L-M Remote Control, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



Manual Remote Control attached to sleet hood of a Kyle Type H Recloser. Device cannot interfere with normal operation of the recloser. Easily installed, right in the field. Flexible steel cable is coupled to length of ⅜" pipe.

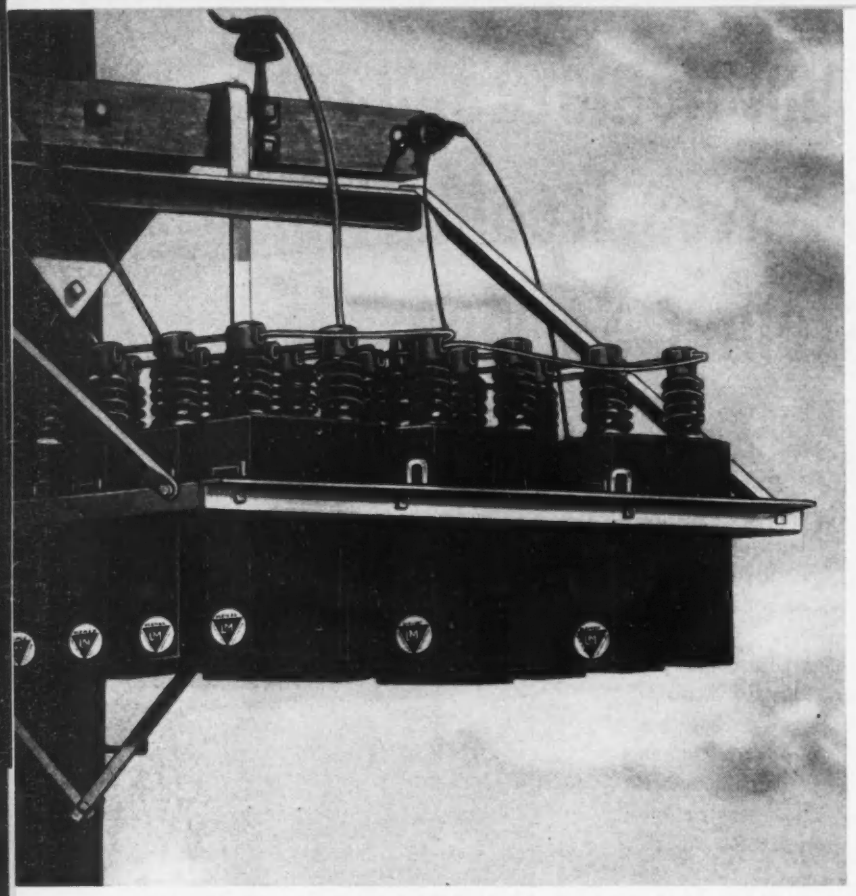
Features of the L-M Manual Remote Control for Kyle Reclosers

- Designed for simple operation from the base of the pole.
- No switch stick required.
- Permanently lubricated for a lifetime of use. Sealed against damage or interference by insects and weather.
- Allows trip-free operation under fault conditions. The device cannot hold recloser in against a fault.
- Easily installed; may be added to Kyle Reclosers right in the field.
- Control handle can be locked to prevent tampering.
- Available for pole or cross-arm mounting for 1-, 2-, or 3-phase operation. One handle operates all reclosers simultaneously.
- Field-tested under various climatic conditions to assure positive operation.

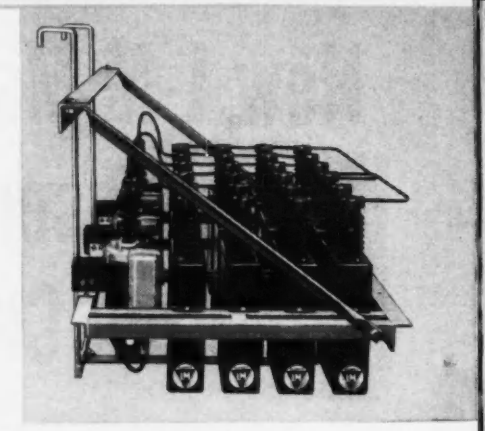
Operating handle at base of pole, also coupled to ⅜" pipe with coupling provided. Handle can be locked to prevent tampering, but is easily operated by authorized persons. No switch stick needed!

LINE MATERIAL

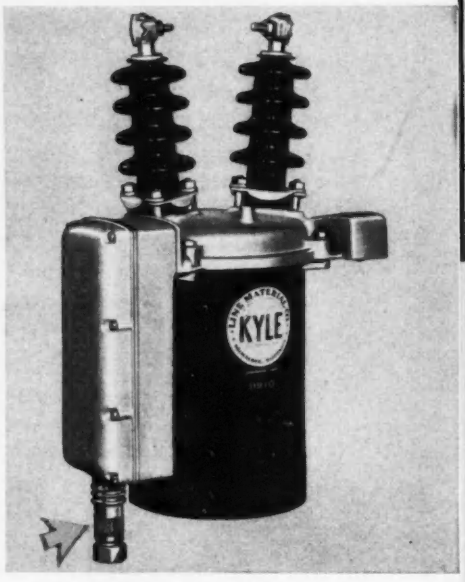
Kyle® Reclosers



A 300 kvar switched capacitor rack installation. Wiring is completely neoprene-jacketed and bird-proof. Racks are available with or without the three L-M Kyle Type NR Oil Switches.



Stress on the pole is no problem—less than one transformer and one secondary drop. Capacitors are mounted vertically—which provides compactness and longer capacitor life.



L-M Kyle Type NR Oil Switch. Only low-cost switch with 200 ampere thermal rating and full 150 ampere nominal capacitive rating at 15 kv. Weatherproof plug-in connection at the base of each oil switch control housing. This makes it easy to connect or disconnect the switch without disturbing any of the wiring. Only one easy-to-reach connection on each switch.

You Save 3 Ways With ELEMEX CAPACITORS

by **DANIEL J. J. PIRHOFER,** Sales Application Engineer, Capacitor Division, Line Material Company

Since utility systems install power factor correction equipment for its economic benefits, you might as well make the saving involved as great as possible. L-M's ELEMEX Capacitors offer 3 special savings:

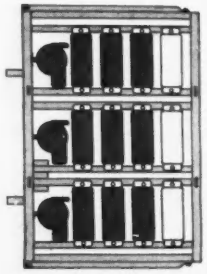
1 You save on installation costs with completely assembled and factory-wired racks.

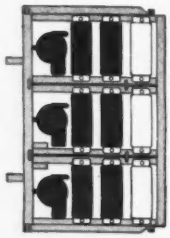
2 You save on over-all life cost because quality design and rigid quality control result in capacitors with an exceptional service record. Failure rate is less than one-half the national average.

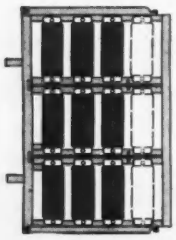
3 You save on automatic switching with L-M's simple, rugged, economical Voltage Control.

Racks and their features are illustrated above. May we give you details of the exclusive process that gives ELEMEX Capacitors such long life, and of the L-M Voltage Control? Ask the L-M Field Engineer for a copy of Bulletin PC-1—and, if you like, a copy of "ABC's of Capacitors." Or, write me at Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

148-1R



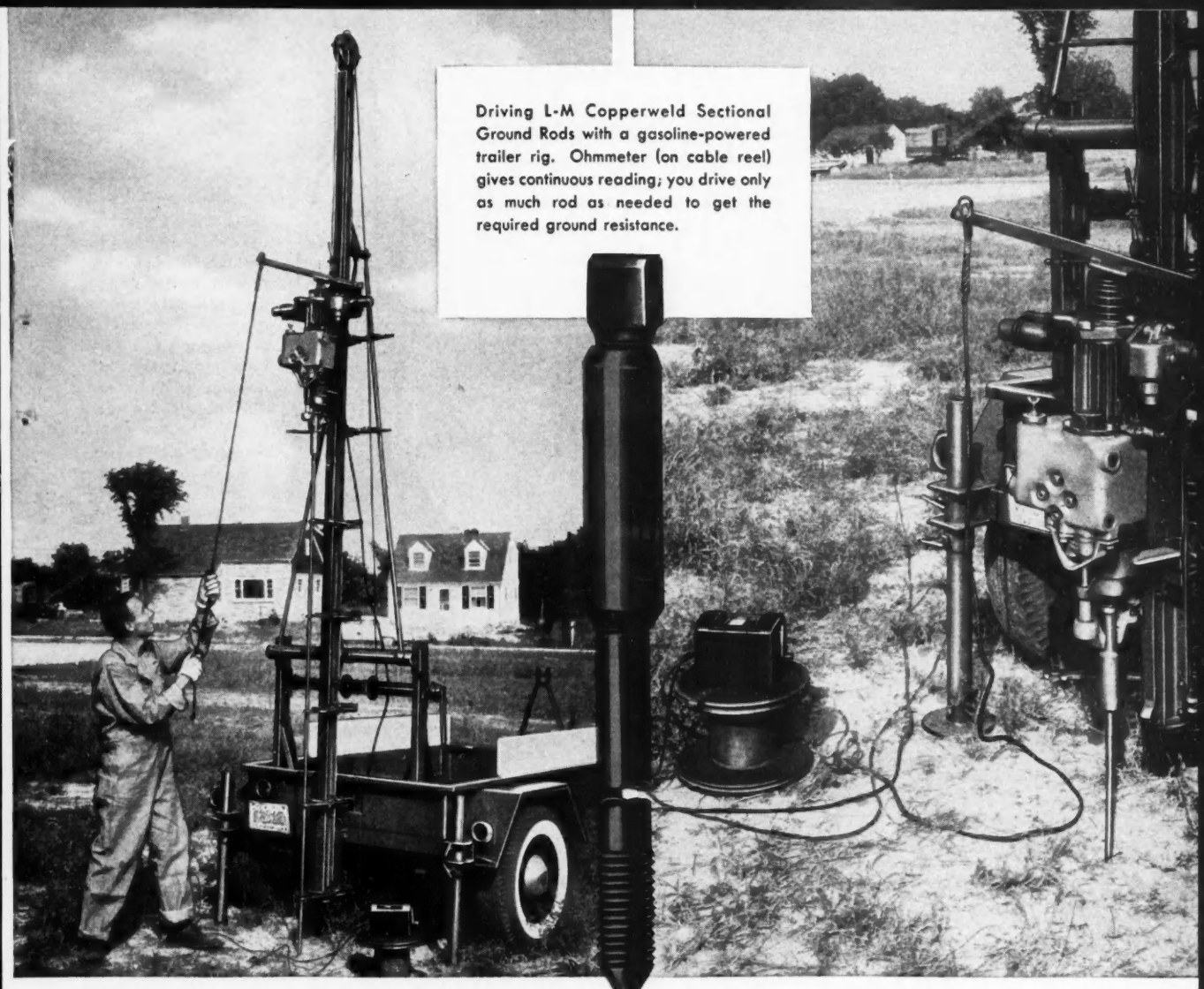




Sizes: with 15 kv spacing; up to 300 kvar switched and 375 kvar unswitched assemblies, all with 25 kvar units.

LINE MATERIAL

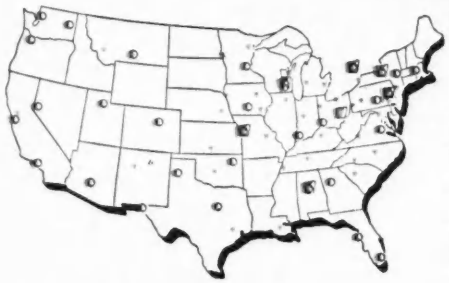
LM Elemex Capacitors



Driving L-M Copperweld Sectional Ground Rods with a gasoline-powered trailer rig. Ohmmeter (on cable reel) gives continuous reading; you drive only as much rod as needed to get the required ground resistance.

Get Low-Resistance Grounds Quickly; Drive L-M Copperweld Ground Rods

TRADE MARK



Stocks in All L-M Warehouses Assure Prompt Delivery to You

Order from the L-M Field Engineer or phone your district L-M Sales Office for the Copperweld Standard or Sectional Ground Rods and Fittings you need. Always plenty right in stock.

Copperweld Ground Rods and Fittings are available from L-M warehouses all over the country. That means you get prompt delivery, when you order Copperweld Grounding Equipment from the L-M Field Engineer.

Copperweld Ground Rods consist of a thick copper covering, inseparably molten-welded to an alloy-steel core that provides strength and rigidity. Copper and steel are permanently interlocked, so they cannot be separated by pounding, temperature changes, or years of service.

For complete information on L-M Copperweld Ground Rods, ask the L-M Field Engineer for a copy of Bulletin DL-4; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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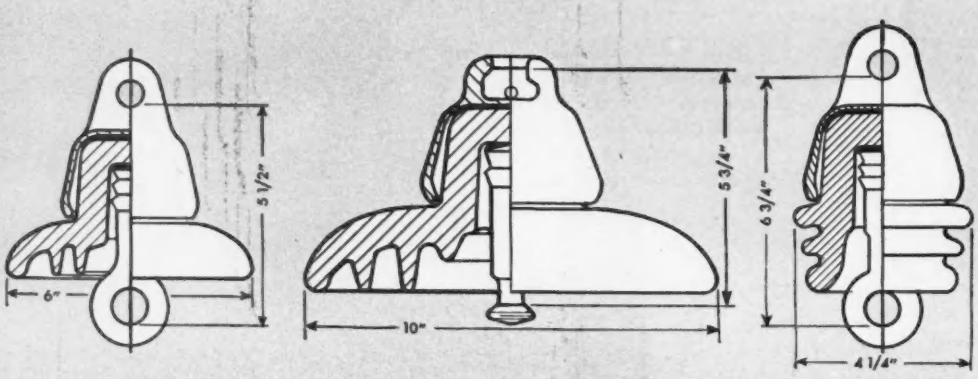
LINE MATERIAL

Line Construction Materials



No. 5000 series strain clamps

These clamps provide a dependable, efficient, low-cost method of dead-ending ACSR, copper, Copperweld-copper, and composite conductors. Easily attached, in the air. Drop-forged steel, heavily galvanized. High-strength steel pins with bronze cotters; lock washers on bolts prevent loosening.

No. 1261 6-inch suspension insulator

Flashover voltages: dry, 60,000; wet, 30,000. Mechanical and electrical strength, 10,000 pounds. Leakage distance, 7".

No. 1253 10-inch suspension insulator

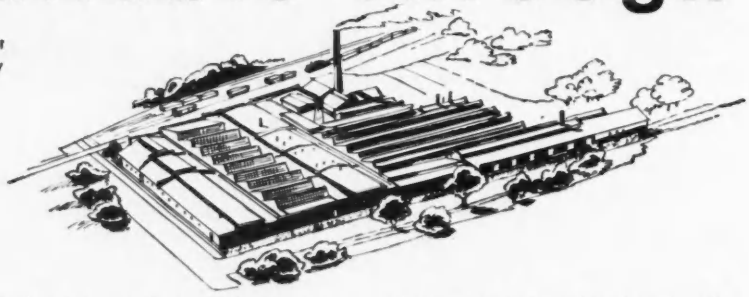
Flashover voltages: dry, 80,000; wet, 50,000. Mechanical and electrical strength, 15,000 pounds. Leakage distance, 11½".

No. 395 distribution suspension insulator

Flashover voltages: dry, 60,000; wet, 32,000. Mechanical and electrical strength, 10,000 pounds. Diameter, 4¼"; length, 6¾"; leakage distance, 5½".

Illinois Electric Porcelain Now Available Through

by **W. V. SWAN**, Vice President
Illinois Electric Porcelain Company

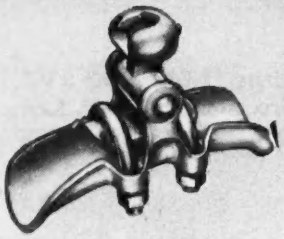


With the acquisition of Illinois Electric Porcelain Company of Macomb, Ill., by McGraw Electric Company, Illinois Electric Porcelain becomes a McGraw Electric subsidiary, and its products for utility companies will be sold exclusively by the Line Material Company Division of McGraw Electric Company.

Illinois Electric Porcelain Company has manufactured pin-type insulators since 1915, and suspension insulators since 1921. To this long manufacturing experience has been added Line Material's broad experience in design, manufacture, and application of electrical porcelain. L-M now offers an extensive line of electrical porcelain that provides a high degree of quality in design and manufacture.

Included in this line are transmission and distribution insulators, insulator hardware, and some special items to meet unusual construction requirements.

Modern plant facilities assure adequate volume and economical manufacture. Quality is carefully controlled through extensive testing of raw materials, processes, and finished products.

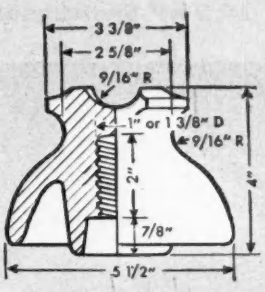


No. 6200A-U series strain clamps

The long, smooth, large-radius conductor seat prevents concentration of vibration-bending and stresses at conductor take-off points. The assembly is light in weight and has short connecting length.

U-bolt clamps maintain permanent high-pressure cable-to-clamp contact and help prevent conductor burning. Drop-forged steel, heavily galvanized; heat-treated high-strength pins with bronze or brass cotters. Types available for ACSR, all-aluminum, stranded copper, Copperweld, Copperweld-copper, and other composite conductors. Sizes from 6½" to 12" long; strengths from 15,000 to 25,000 pounds.

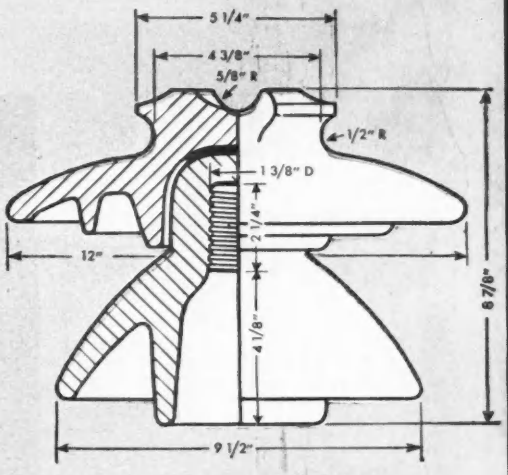
An extensive line of suspension and strain hardware accessories is available to meet almost every standard and many special requirements.



No. 266 distribution pin-type insulator

No. 2055 transmission pin-type insulator

Low and high voltage pin-type insulators. Above, No. 266 distribution insulator—70 kv dry flashover—is 5½" in diameter and 4" high. The No. 2055 transmission insulator at right has 145 kv dry flashover, is 12" in diameter and 8⅞" high, has 27" leakage distance. Parts are strongly joined with neat portland cement, carefully cured to assure highest possible strength.



Company Products
Line Material Company

Designs provide more than adequate leakage distance in each rating class. Cementing of multi-part insulators is done with neat portland cement, carefully cured under controlled conditions of humidity and temperature to assure extremely strong joints—as strong as the porcelain itself.

Get Full Information

Illinois Electric Porcelain products are available through L-M Field Engineers, sales offices, and warehouses throughout the country. Ask the L-M Field Engineer for information on Illinois Electric Porcelain products; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division)

ILLINOIS ELECTRIC PORCELAIN COMPANY

(a McGraw Electric Company Subsidiary)

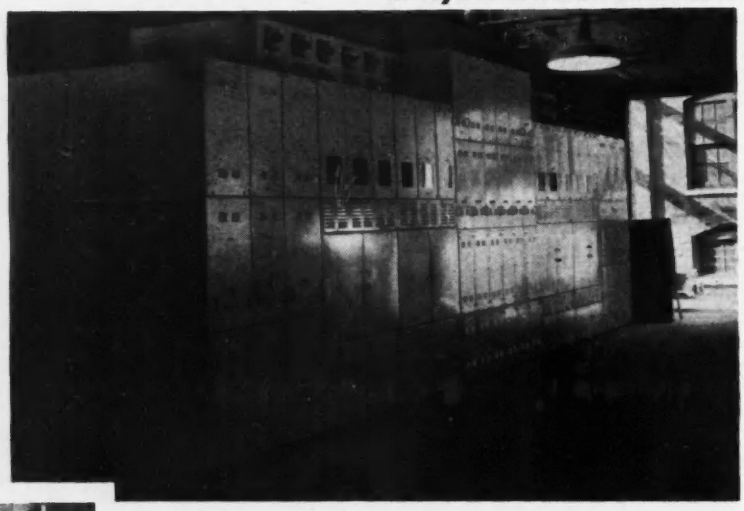
LINE MATERIAL
Electric Porcelain Insulators

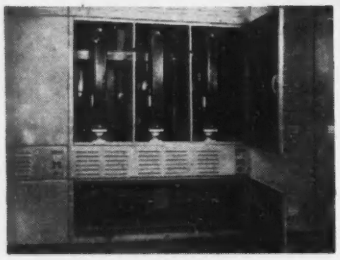
149

Illinois Electric Porcelain Company products are sold to utilities exclusively by Line Material Company (a McGraw Electric Company Division)

well worth looking into...

14.5 kV Switchgear, 2,000 Amps. 1,000,000 kVA, in Hydro Station in U. S. A.





BROWN BOVERI

station-type AIR BLAST BREAKER SWITCHGEAR

THIS proven-in-use station-type, air blast breaker switchgear provides unique ***plus values*** of decided importance. . . .

1. ***Unusually High Speed*** — (Breaker opening time 3 cycles.)
2. ***Circuit Breaker Easily Accessible for Maintenance*** because of the sliding interphase barriers.
3. ***Complete Breaker is Removable as a Unit*** for inspection and overhauling.
4. ***Compressed-Air-Operated Disconnects Fully Interlocked with Breaker and Compartment Doors.***

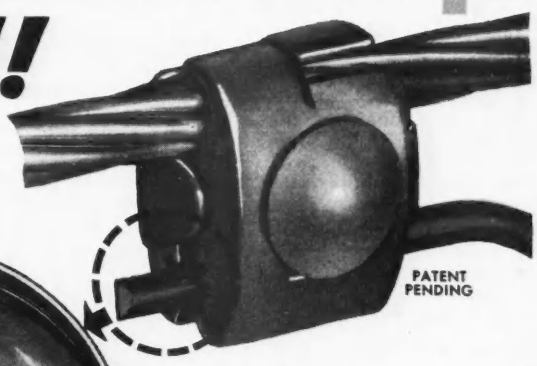
This switchgear is LOW in initial cost, installation and maintenance. It incorporates ALL of the personnel-safety, no-fire-hazard and basic economy features of world-famous BROWN BOVERI air blast breakers. This switchgear is normally supplied from 7.2 kV to 23 kV. It will pay you to get all the facts about this outstanding switchgear.

WRITE FOR DATA!

BROWN BOVERI CORPORATION
19 Rector St., New York 6, N. Y.

BROWN BOVERI

REVOLUTIONARY NEW DESIGN of ALUM-COPPER Parallel Groove Clamp! by BLACKBURN!



NEWLY DEVELOPED PROCESS . . . eliminates use of solder in attaching copper liner to cast aluminum body — no moisture trapping voids or corrosive fluxes between liner and body to foster galvanic corrosion.

COPPER LINER PERMANENTLY LOCKED IN — SEALS OUT MOISTURE!

Aluminum body is pressure cast around the pronged copper liner. Because the aluminum body has a greater coefficient of contraction than the pronged copper liner, it exerts great clamping forces against the prongs as the molten aluminum solidifies. This air-tight shrink-fit permanently seals out moisture.

Operating temperatures under the most severe conditions never approach the heat of the aluminum in its molten state, therefore high clamping forces against the pronged liner are retained . . . liner cannot come loose.

HIGH CONDUCTIVITY

Special surface treatment of the under side of the copper liner reduces surface tension of the molten aluminum. This establishes an intimate low-resistant contact between the two metals.

STRONG — CORROSION RESISTANT

Aluminum bodies are cast of a special alloy, selected for its high corrosion resistance. This alloy is exceptional in that it also combines high strength with ductility. Steel bolt, nut and lock washer are hot dipped galvanized.

SIMPLIFIES STOCKING PROBLEMS

One clamp covers a wide range of popular conductor sizes.

ORDERING INFORMATION

	Copper	Aluminum
PAC 6/0	8 AWG to 2 stranded	6 ACSR to 1/0 ACSR

Mail Coupon Below for FREE Sample — or — Order TODAY!

JASPER BLACKBURN CORPORATION
35 Madison St. — St. Louis 6, Mo.
Phone CEntral 3007

BLACKBURN *Parallel Groove* **CLAMPS**

FREE SAMPLE-MAIL TODAY

JASPER BLACKBURN CORPORATION
35 Madison St., St. Louis 6, Mo.

Send FREE Sample of New ALUM-COPPER Parallel Groove Clamp.

Your Name and Title.....

Firm.....

Address.....

City and State.....

Application engineering . . . *essential to control*

No matter what the product, every plant uses methods, materials and equipment that present problems peculiar to its own production. Specifications . . . size of plant . . . rate of output . . . all impose further unique restrictions.

What, then, about process control instrumentation? To do its job right, it has to be designed with all those factors . . . and many others . . . in mind. And here is where Honeywell Application Engineering steps in.

First comes a thorough investigation of control requirements. A Honeywell engineering representative, well versed in instrumentation techniques sits down with process engineers, production men, and instrument technicians . . . discusses details of the specific process. Then he puts the problem up to Honeywell's staff of application engineers.

Specialists for Each Industry

In this group are men who are expert in each specific industry. One group, for example, specializes in instrumentation for the metalworking industry . . . another for chemical . . . another for petroleum . . . until the whole gamut of modern manufacturing is represented. Each man has been trained, by education and first-hand experience, in the techniques of processing and process control in the area of his interest. Each is a living part of the industry he serves. And he knows why and where every process "is different."

Covers All Aspects of Control

Honeywell application engineering covers the entire control installation. It works out details of what instrument to use for each measurement or control function . . . what type of primary element . . . what control system . . . what size and style of valve. It provides all essential signals, safety interlocks, and accessories. It combines all these elements into a complete unit, arranged for peak production efficiency . . . greatest convenience of the operator, and for maximum ease of service . . . custom-fitted to the individual needs of the process to be controlled.

Saves Time . . . Produces Top Performance

This Honeywell service gives specialized consultation on complex control problems that would otherwise require the attention of experts in the individual plant. But most important, it assures a control system that will produce the superior performance that Honeywell instruments are capable of giving . . . and which will help to obtain the most production and best quality from the process which it serves.

Remote measuring *centralized*

SOUND PLANNING, *based on specialized engineering experience, forms the basis of Honeywell Application Engineering. Here a round-table discussion between customer and Honeywell technicians irons out the initial control requirements for a process.*

WHEREVER you need to bring measurements of flow, liquid level and pressure from out in the plant to a central control room, you'll find Brown remote measuring systems provide the performance you need. Utilizing pneumatic transmission, these systems consist of an appropriate transmitter and sensing element at the point of measurement—connected by small-diameter tubing to recording and controlling instruments on the main or auxiliary control boards.

They're accurate: operate over distances of several hundred feet with full responsiveness. Transmitter and receiver are precision-matched in design.

They're dependable: rugged design keeps calibration constant, from detection to final measurement. Simple construction minimizes maintenance.

Brown pneumatic transmission systems are supplied in a wide choice of ranges for power plant service.

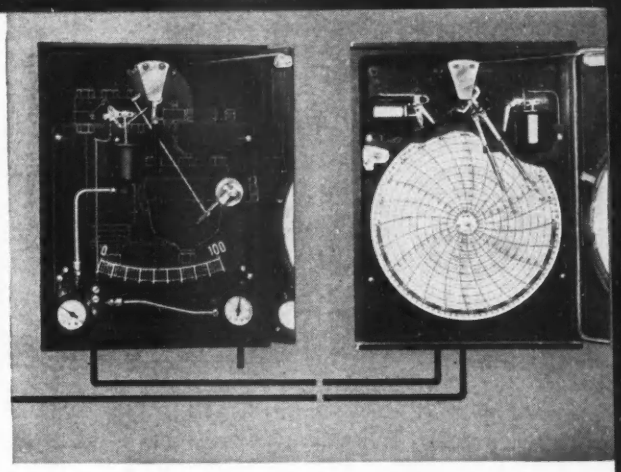
systems for *plant control*

Electric systems are also available for these same variables. Your local Honeywell engineering representative will welcome the opportunity to discuss your own plant's applications . . . and he's as near as your phone.

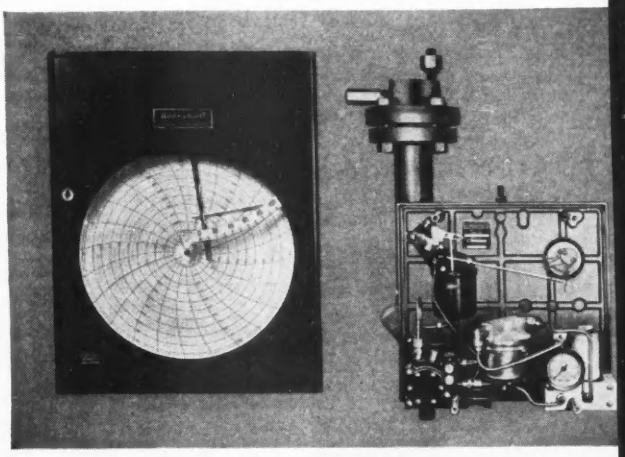
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa. Sales and service offices in more than 90 principal cities of the United States and Canada.

● **REFERENCE DATA: Write for Catalog 90-2, "Supervisory Instruments for Power Generation," and for Data Sheet No. 9.1-4.**

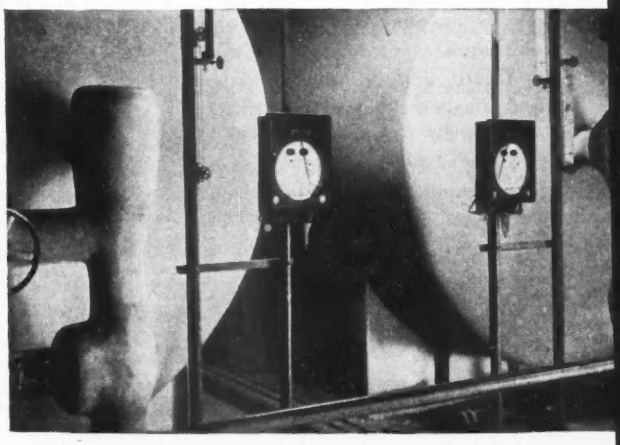
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls



REMOTE PRESSURE MEASUREMENT: *Brown systems cover the range from super heat pressures to condenser vacuum. Only low-pressure instrument air goes to the control board. Dangers of high-pressure piping are eliminated . . . panel costs are reduced.*



REMOTE FLOW MEASUREMENT: *systems can be either the square root type (electric or pneumatic transmission) or evenly graduated (electric transmission). The latter is ideal for flow cost accounting . . . has a linear scale that provides full readability at all flow rates.*



REMOTE LIQUID LEVEL MEASUREMENT: *keep operators informed of level in condensate tanks, hot wells, boiler drums and other remote locations. Systems are supplied for open tanks, closed pressure vessels, corrosive liquids, and liquids containing suspended solids.*

PROBLEM:

Industrial Contamination

LAPP LINE POST

"All-time champion" among transmission insulators in point of service dependability at duty up to 69 kv. Its record, both on new construction and after reinsulation of lines to higher voltages, has been built on ability of Line Post to avoid leakage flashover, to withstand lightning arcover and mechanical attack, its inherent freedom from puncture and cracking.

LAPP STATION POST

In addition to the superior electrical and mechanical characteristics inherent in Lapp Post design, Station Posts also possess extra rigidity. Cap and base are externally attached for large-area low-intensity compression loading of porcelain, as contrasted to small-area, high-intensity loading of nested porcelain and metal parts in conventional pin-cap switch insulators.

LAPP FOG-TYPE SUSPENSION INSULATOR

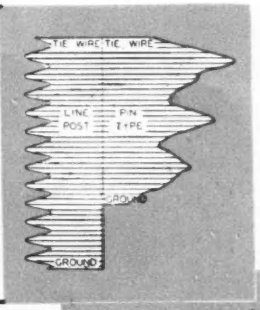
For high-voltage lines in areas of severe contamination—salt fog, industrial fumes, or dust—Lapp Fog-Type suspension units provide maximum leakage distance per length of string—and for greater effectiveness of leakage distance, inch for inch.

SOLUTION: Lapp Fog-Type Design

Service dependability on lines subjected to severe contamination . . . industrial smoke and fumes, dust, or salt fog . . . can be assured—without frequent cleaning of insulators—and without danger of failure from leakage flashover. Lapp Fog-Type design provides superior performance for transmission, switch and bus support because of two basic superiorities of design principle . . .

1. UNIFORM LEAKAGE PATH

Leakage flashover results from a contaminated surface which is not uniform—wet areas lower total resistance, so increase leakage current until voltage flashes over narrow shielded areas, precipitating flashover of entire unit. Compare developed uniform leakage surfaces of 66 kv Line Post (on left side) with that of conventional pin-type (right) where variation in conductivity is 3.6 times as great.

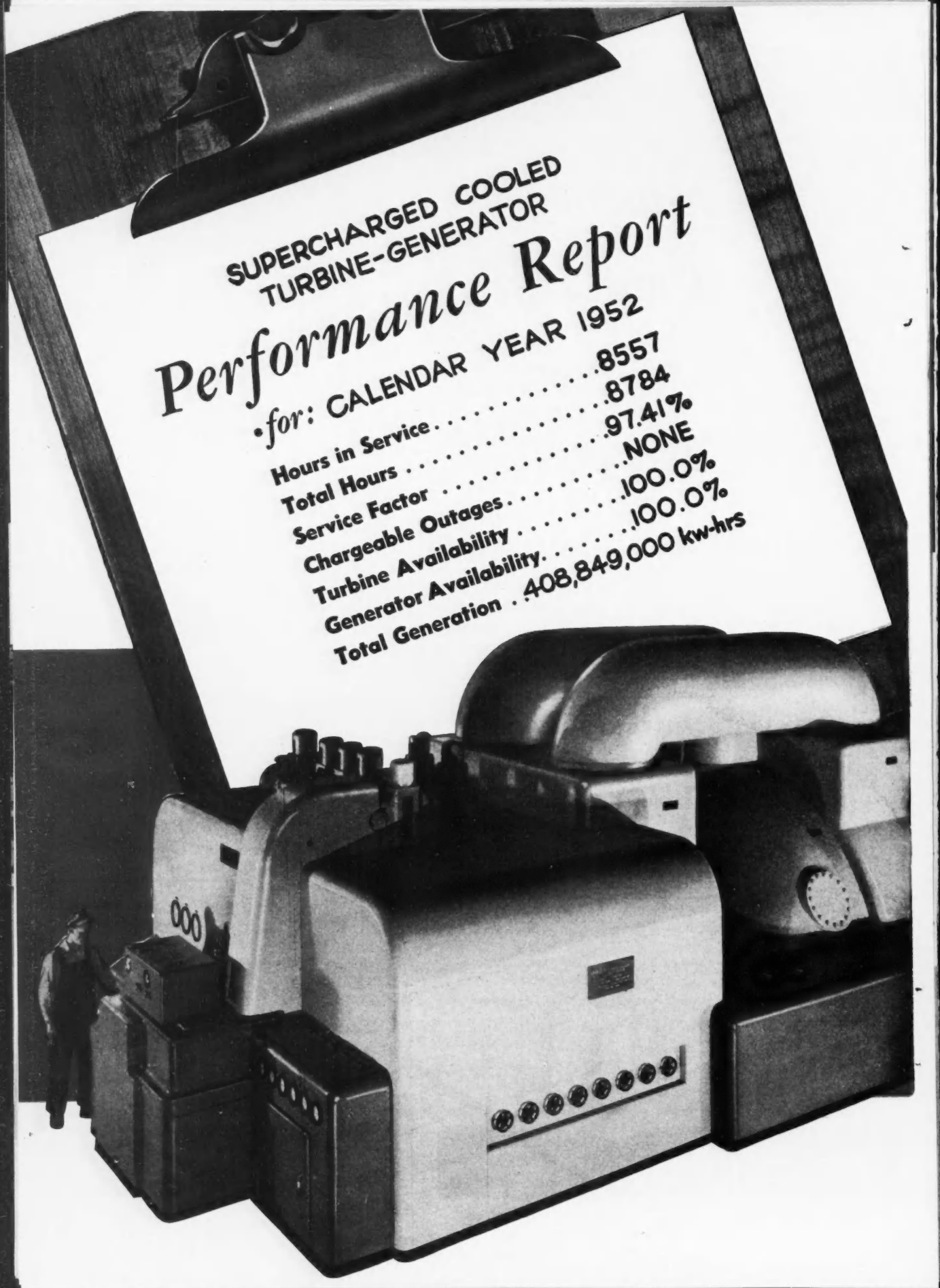


2. SELF-CLEANING

Under heavy rain and wind, contamination rapidly flushes away. Fog-Type petticoats are so shaped and spaced that rain falling on one petticoat splashes and cleans the under side of the one above. Resistance increases, leakage current falls—uniformly and over entire unit.

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, NEW YORK


SUPERCHARGED COOLED
TURBINE-GENERATOR
Performance Report
•for: CALENDAR YEAR 1952
Hours in Service 8557
Total Hours 8784
Service Factor 97.41%
Chargeable Outages .....NONE
Turbine Availability 100.0%
Generator Availability 100.0%
Total Generation . 408,849,000 kw-hrs

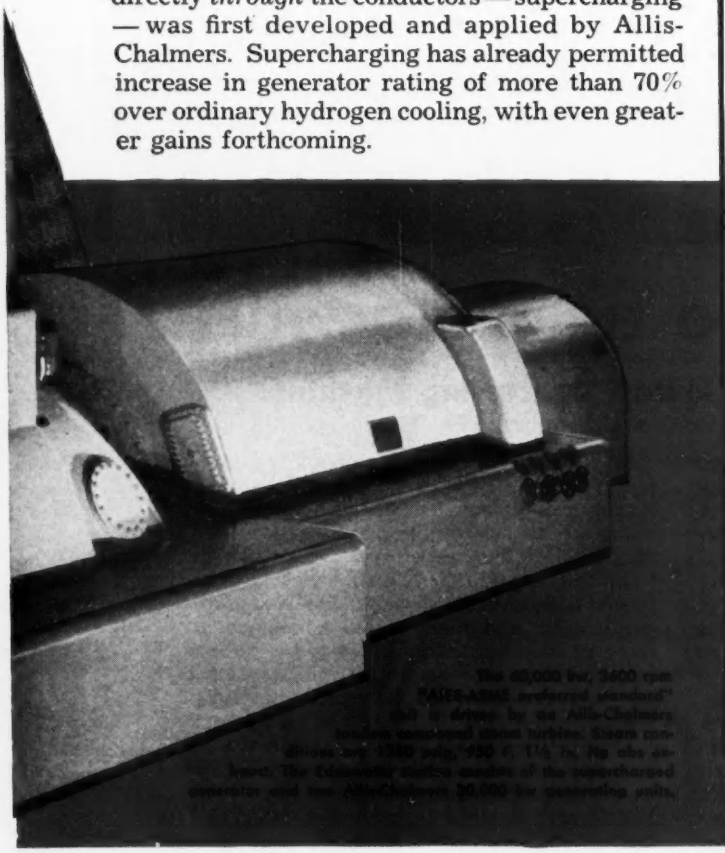
Availability for Duty: 100.0%!

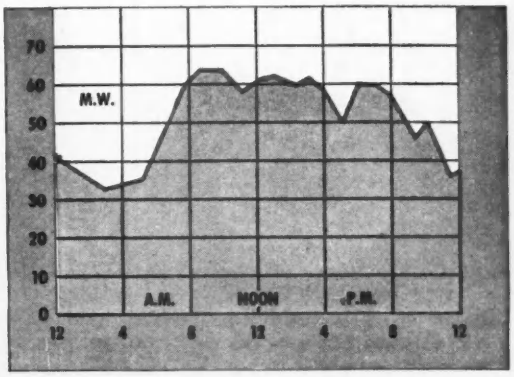
Supercharged Hydrogen Cooling — the greatest advance *ever* made in turbine generator design — has proved itself brilliantly in its first full year's commercial operation!

At left is the calendar year 1952 Performance Report on the Allis-Chalmers 60,000 kw steam turbine generator unit at the Edgewater station, Sheboygan, Wisconsin Power and Light Company. Both turbine and generator Availability were 100.0%, with on-the-line Service Factor over the entire year being 97.41%.

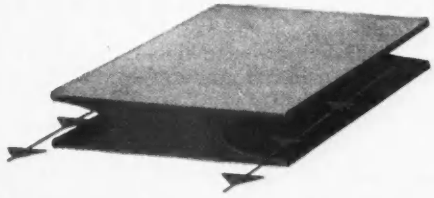
Cooling by driving hydrogen at high velocity directly *through* the conductors — supercharging — was first developed and applied by Allis-Chalmers. Supercharging has already permitted increase in generator rating of more than 70% over ordinary hydrogen cooling, with even greater gains forthcoming.

You get the real design advances *first* from Allis-Chalmers, builder of the world's widest range of power plant equipment. When planning a steam-electric power plant, your task will be simpler and results better if you deal with Allis-Chalmers. For complete literature on all products, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3981





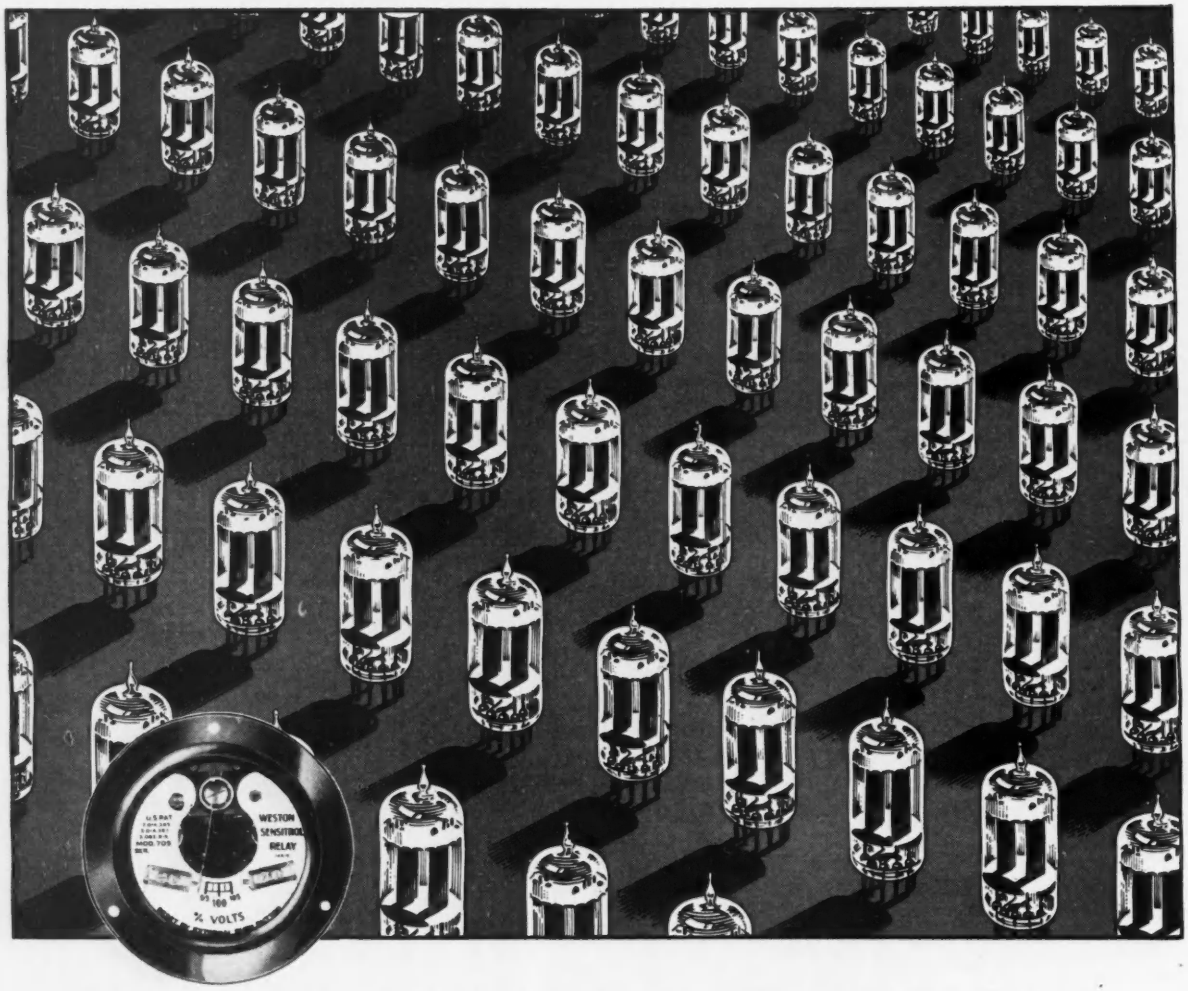
Typical daily load cycle of the Sheboygan supercharged unit. It experiences wide load fluctuations because it operates in parallel with base load hydro power. Supercharged units are suited for even this strenuous duty because of high part load efficiency and shorter, more thermally stable construction.



Cross sectional view, showing two turns of typical supercharged conductor construction. The cooling gas is in intimate contact with the copper, removing the heat right where it originates. The heat does *not* have to migrate through insulation and surrounding metal to reach vent ducts in the rotor teeth or body.

ALLIS-CHALMERS

FIRST with Supercharged Hydrogen Cooling!



MONITOR OF 3500 ELECTRONIC TUBES

in the new IBM Electronic Data Processing Machines

Ever wonder what makes these new "electronic brains" tick . . . what's *inside* the new IBM Electronic Data Processing Machines that will perform more than 16,000 addition or subtraction operations a second?

At the heart of these machines are computing and storage chests containing 3500 electronic tubes and over 12,000 diodes . . . thus giving them tremendous computing speed, enormous storage capacity, and ultra-fast access to stored data.

The protection of this intricate electronic circuit against oversupply or loss of D-C power presents a highly critical problem. For, to protect the tubes and insure accuracy in all computations, all voltages employed must be correct and available at all times, and differing voltages applied and removed in their correct order.

So the "voltage monitors" employed in these machines are WESTON Sensitrol® Relays . . . *permanent* components that instantly detect voltage variations and sound an alarm, or stop the machine, before damage or inaccuracies can occur.

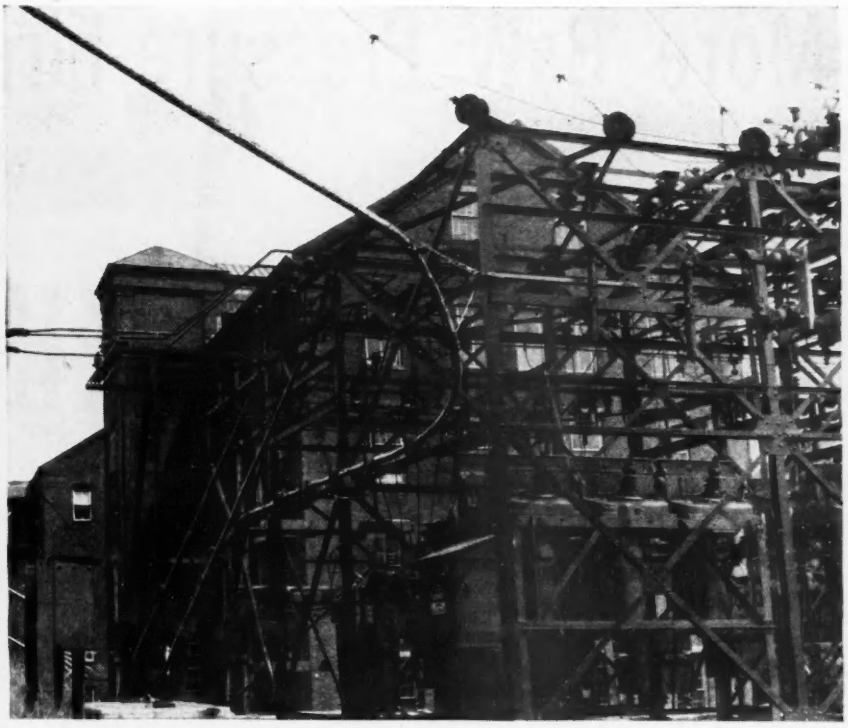
In this application Sensitrol Relays are employed because of their *permanency*, unfailing dependability, and their exclusive magnetic contacts. In other applications they are used for their high sensitivity . . . operating at values at low as ½ microampere or ¼ millivolt, yet handling substantial wattage at 110 volts on their unfailing contacts.

Sensitrol Relays are just one member of a line of sensitive instruments which have kept WESTON leader in precise instrumentation since 1888 . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J. 4828

®Reg. T.M.

WESTON **WESTON** *Instruments* . . . Indicate — Record — Control

"neither snow, nor rain, nor heat...."



These famous words* carved over the main entrance of the New York Post Office very aptly apply to the public utility systems of this country.

Distribution systems of public utilities must be as dependable and constant as the proverbial postman in his appointed rounds. That's why it is false economy to buy distribution wire and cable of any kind that isn't the most dependable that money can buy. It isn't a question of whether you can afford to buy the best; the question should be turned around, "Can you afford not to buy the best?"

For high voltage circuits, we think you are practicing false economy if you don't install cables insulated with Simplex-ANHYDREX XX. These cables can be used underground in or out of ducts, or overhead on messenger wire. They are heat, ozone, water and age resistant. They are rated for operation at 80°C. in wet or dry locations at voltages from 2,001 to 17,000 V.W.P.

Why don't you insure the continued operation of your distribution circuits by installing Simplex-ANHYDREX XX Cables now?

** The complete quotation is, "Neither snow, nor rain, nor heat, nor gloom of night stay these couriers from the swift completion of their appointed rounds."*

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts

More B&W Pressure-Fired Boilers

Two 125,000 KW Units

Low-cost kilowatts with top availability was the aim of the designers of the two new generating units for Delaware Station of Philadelphia Electric Company. Helping to achieve that aim are many of the design features in the two new B&W Radiant Reheat boilers which have recently gone into operation. These include pressure-firing, divided furnaces, high initial and reheat steam temperatures, Cyclone Steam Separators for natural circulation, and spaced burners.

Greater Economy with Pressure-Firing

Ease of operation, worthwhile power and fuel savings, and reduced maintenance—these are all made possible by pressure-firing. The pressure-tight furnaces for these units incorporate the many features developed through B&W's extensive experience with this engineering advancement. *More than fifteen large pressurized B&W coal-fired boilers are now in operation, some for as long as five years.* More than 70 additional pressure-fired units are under construction. The accumulated knowledge gained from these installations is at your disposal when you decide to go to pressure-firing.

Smaller Building, Freedom from Slag, with Divided Furnaces

Substantial reduction in building volume for given boiler capacity results from B&W's simple divided-furnace construction, with the ability to absorb heat from both sides of the division wall. This feature is also important in reducing slag accumulation on furnace and convection surfaces.

Positive Circulation, Clean Steam with Cyclone Separators

Adequate circulation of water throughout the unit, with drum design pressure of 2075 psi, is assured with safety by B&W's efficient Cyclone Steam Separators. Cyclones also assist in sending steam of a very high purity to the turbine, helping maintain turbine efficiency and reducing frequency of outages for turbine cleaning.

Greater Safety and Efficiency with Spaced Burners

The use of spaced-burners is ideally suited for higher efficiency with greatest flame stability at low loads. It permits cutting out the lower burners entirely, and keeping a safe firing rate in the upper rows of burners. This gives the higher steam temperatures needed for good efficiency, while insuring stable firing. There is no need for operators to keep oil-lighters on to guard against loss of flame, such as might occur when the firing rate must be spread over many burners.

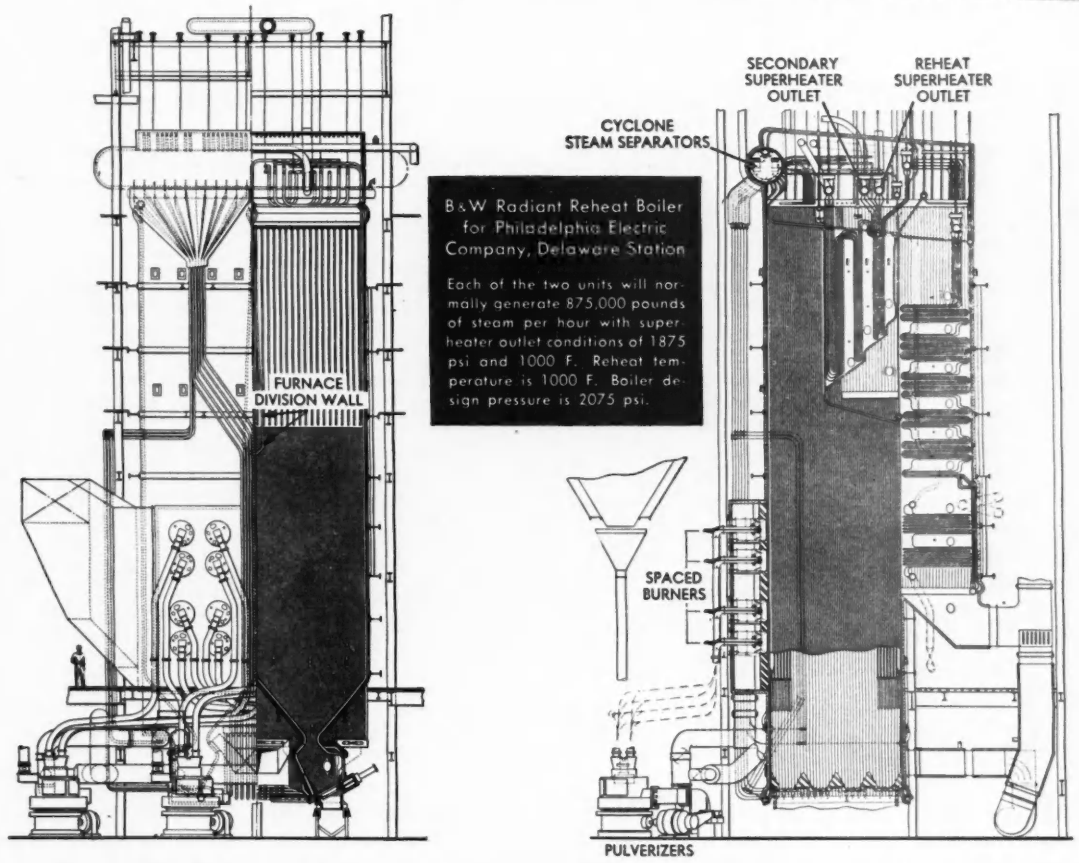
These and many other B&W engineering advances are available to you.
We will be pleased to discuss their application to your future boiler plans.

BABCOCK & WILCOX
BOILER DIVISION

G-619

in Operation

Delivering LOW-COST Power at Delaware



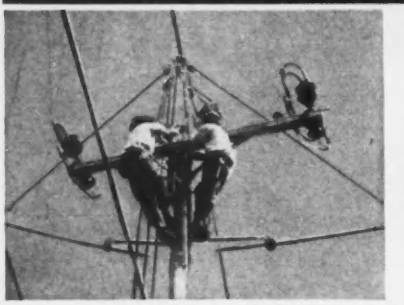
B&W Radiant Reheat Boiler for Philadelphia Electric Company, Delaware Station

Each of the two units will normally generate 875,000 pounds of steam per hour with superheater outlet conditions of 1875 psi and 1000 F. Reheat temperature is 1000 F. Boiler design pressure is 2075 psi.

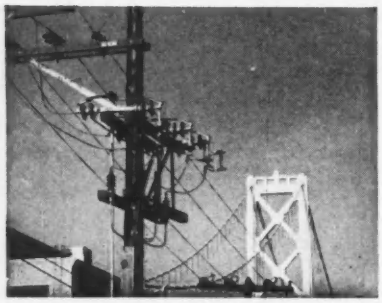
KPF

AIR BREAK SWITCHES

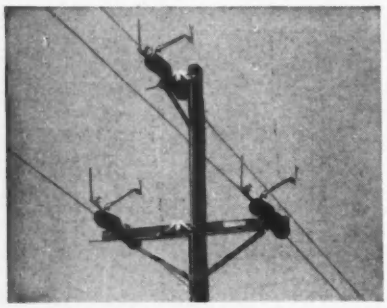
Standard for nearly half a century



Installing KPF Type A-202 switch hot on 12 kv line. KPF phase units are shipped completely assembled, ready for quick installation.

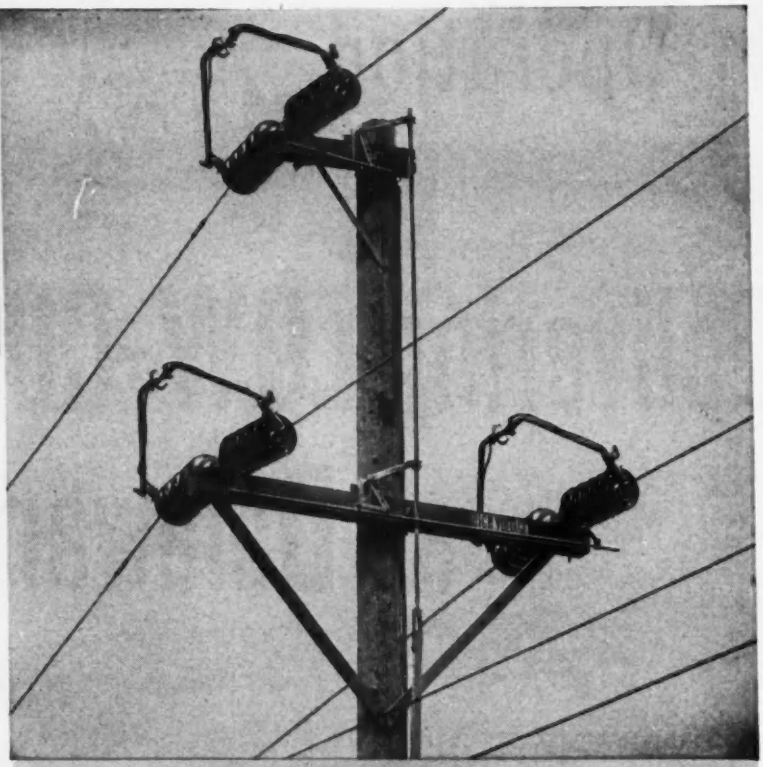


Horizontal-mounted KPF Type UF-2 switch in metropolitan service (P.G.&E., San Francisco). Versatile KPF switches operate equally well with or without line tension.



KPF Type S-205 switches with inexpensive Quick-Break attachment on 60 kv rural transmission line. Switch shown in open position.

2625



Basically different switch design proven in decades of service with leading utilities

Service-proved KPF switches look different because they *are* different.

Their simple, sturdy design insures freedom from mechanical failure or lubrication worries, and virtually eliminates maintenance. Self-aligning silver surfaced blades operate smoothly despite severe ice or crossarm warpage conditions. Installation is fast and economical—switches are bolted directly to crossarms on the ground or in the air. No separate strain insulators or extra crossarms are required; integral insulator stacks readily adjust to line sag.

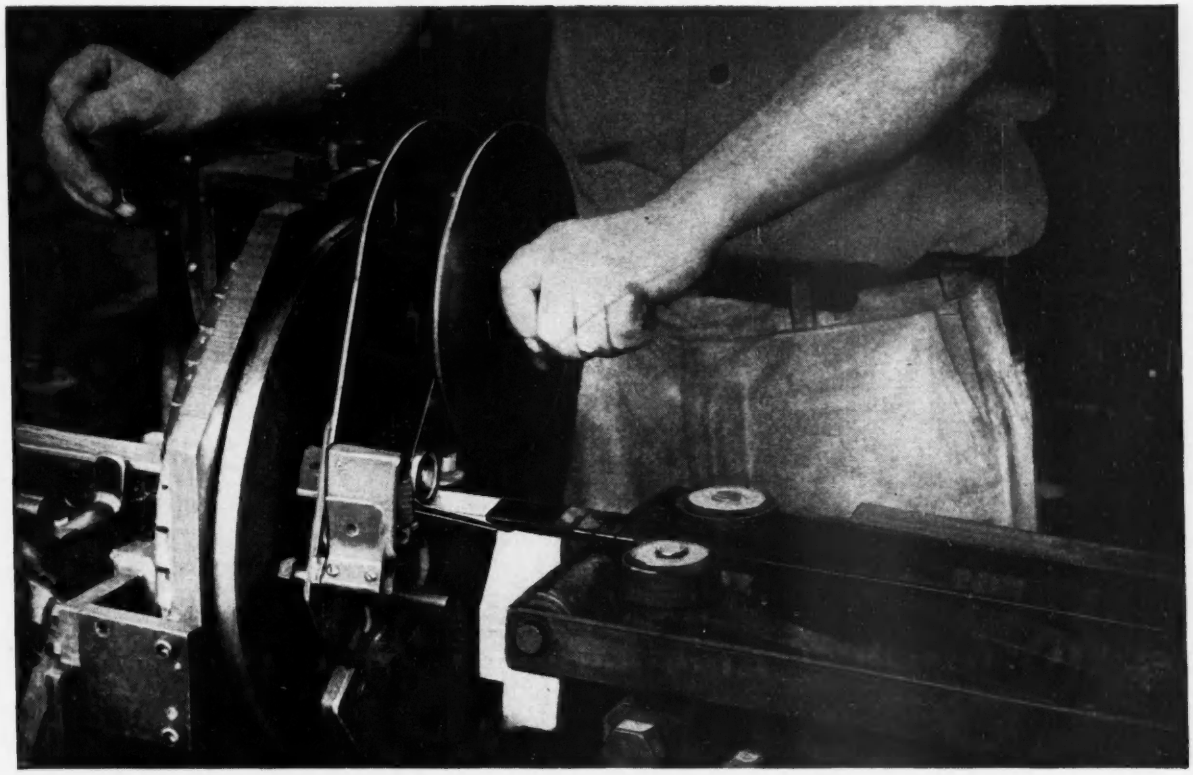
KPF switches have been used for almost 50 years on lines ranging from 7.5 to 110 kv. Tens of thousands are in use today by Pacific Gas & Electric, Southern California Edison, Minnesota Power & Light and other leading power companies throughout the world.

For the world's simplest, surest, lowest cost air break switch, specify KPF—standard for nearly 50 years.

New catalog gives complete specifications, detail drawings, installation information.

KPF ELECTRIC COMPANY

1624 East Alpine Avenue, Dept. E-1, Stockton 5, California



Wrap bus bars quickly, easily, with IRVINGTON heat-and oil-resistant TEMFLEX® 105 Tape

With its high modulus of elasticity, Irvington's Temflex 105 Tape is exceptionally suitable for use in taping heads to produce close, carefully lapped wraps on bus bars or other conductors — without excessive elongation of the tape.

Flexibility, strength and excellent elongation make Temflex 105 Tape equally adaptable to the *hand* wrapping of irregular surfaces — such as cable splices or joints in bus bars. Tape bakes easily to a homogeneous mass — effects substantial economies over other types.

Temflex 105 Tape offers unusual resistance to heat and oil — it is based on the same formula that has made Temflex 105 Plastic *Tubing* the standard wherever service calls for continuous operation in air at 105° C., or in oil at 90° C.

Look to
IRVINGTON
for Insulation Leadership

INSULATING VARNISHES
VARNISHED CAMBRIC
VARNISHED PAPER
VARNISHED FIBERGLAS
INSULATING TUBING
CLASS "H" INSULATION

Get the full facts on characteristics and application of this Irvington insulating material — mail the coupon for technical data sheet.

Send this convenient coupon now

Irvington

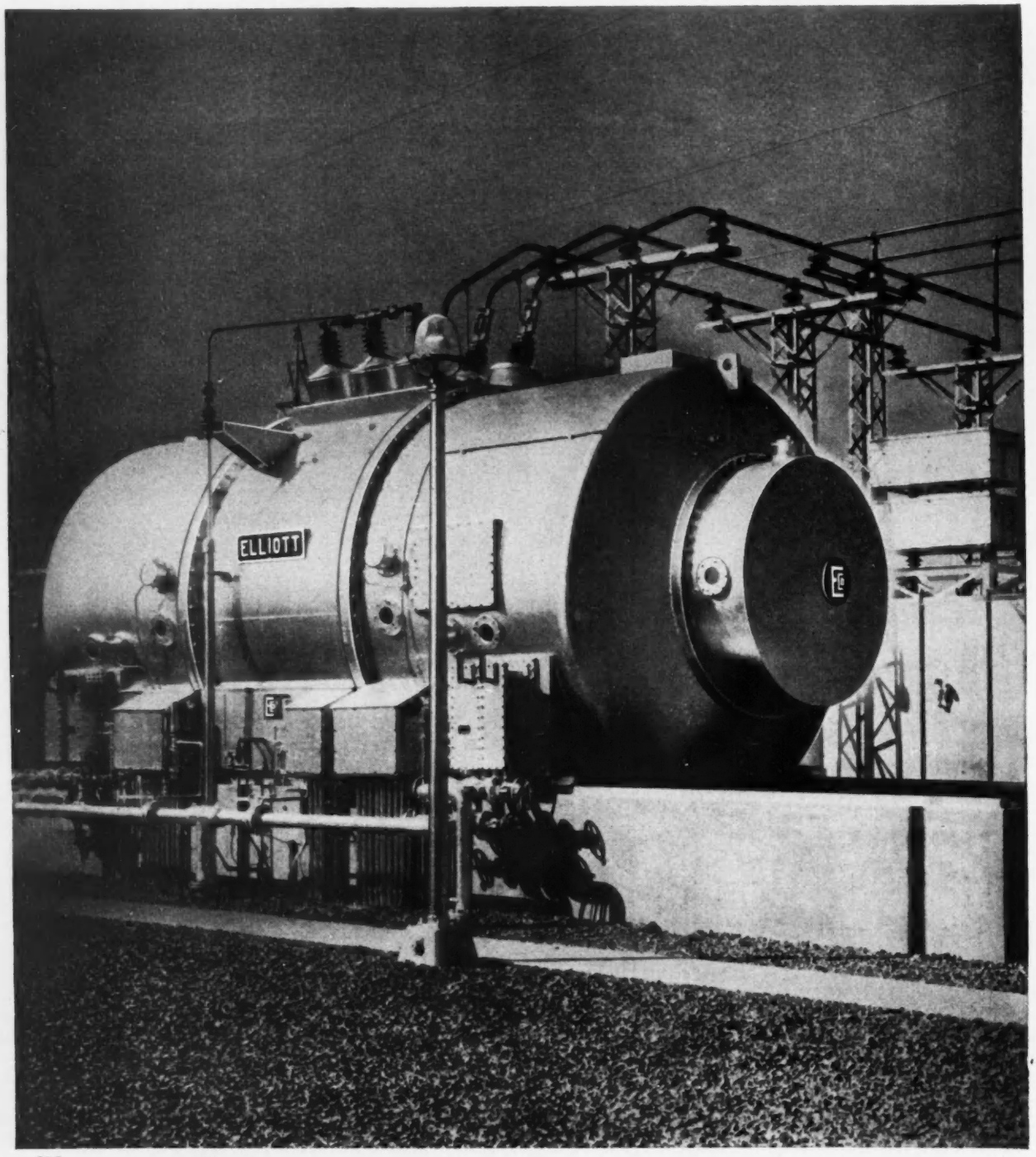
VARNISH & INSULATOR COMPANY
21 Argyle Terrace, Irvington 11, New Jersey
Plants: Irvington, N. J.; Monrovia, Calif.; Hamilton, Ontario, Canada

Irvington Varnish & Insulator Company EW 11/53
21 Argyle Terrace, Irvington 11, New Jersey

Gentlemen:

Please send me technical data sheet on Temflex 105 Tape.

Name..... Title.....
Company.....
Street.....
City..... Zone..... State.....

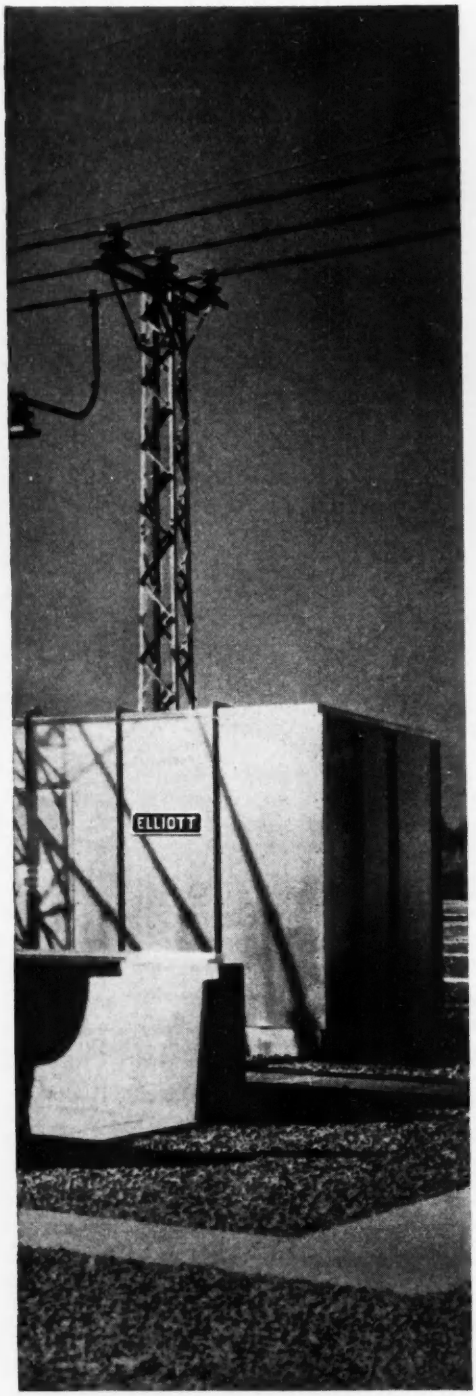


R3-5

The continuous rating of this unit is: 50,000 kva, zero power factor leading, at 0.5 psi gas pressure; 60,000 kva, zero power factor leading, at 15 psi gas pressure; 21,000 kva, zero power factor lagging at any gas pressure. Voltage rating: 13,800 volts. The condenser is started from a low-voltage tap on an auto-transformer in the substation.

ELLIOTT

RIDGWAY



For controlling system voltage Or to increase system stability

ELLIOTT

Outdoor Hydrogen-cooled SYNCHRONOUS CONDENSERS

Shown at the left is a 50,000 kva unit, located at Alvey Substation, Bonneville Power Administration, Goshen, Oregon. It is one of four identical units which will give B.P.A. improved system stability and voltage control.

This Elliott condenser features an excitation system of unique design, meeting a response ratio of *6.0*, measured in accordance with A.S.A. Standard C42-1941 and enables the condenser to deliver a momentary output of 120,000 kva, zero power factor leading.

There is no pit under this condenser — no expensive cored-out foundation. The unit rests on a simple and economical reinforced-concrete base. Weight and size are reduced by judicious proportioning of stator, rotor and end domes. This means lower cost for the foundation and a saving for the user in cost of maintenance. All controls are engineered by Elliott to make these condensers self-contained units and completely automatic in operation.

The control housing of weatherproof metal-clad design, adjacent to the condenser, encloses voltage regulator equipment, switchboards, gas control panels, and auxiliaries. The housing, of sectionalized construction, can be disassembled and moved to a new location with the condenser, should future load conditions require it.

Company

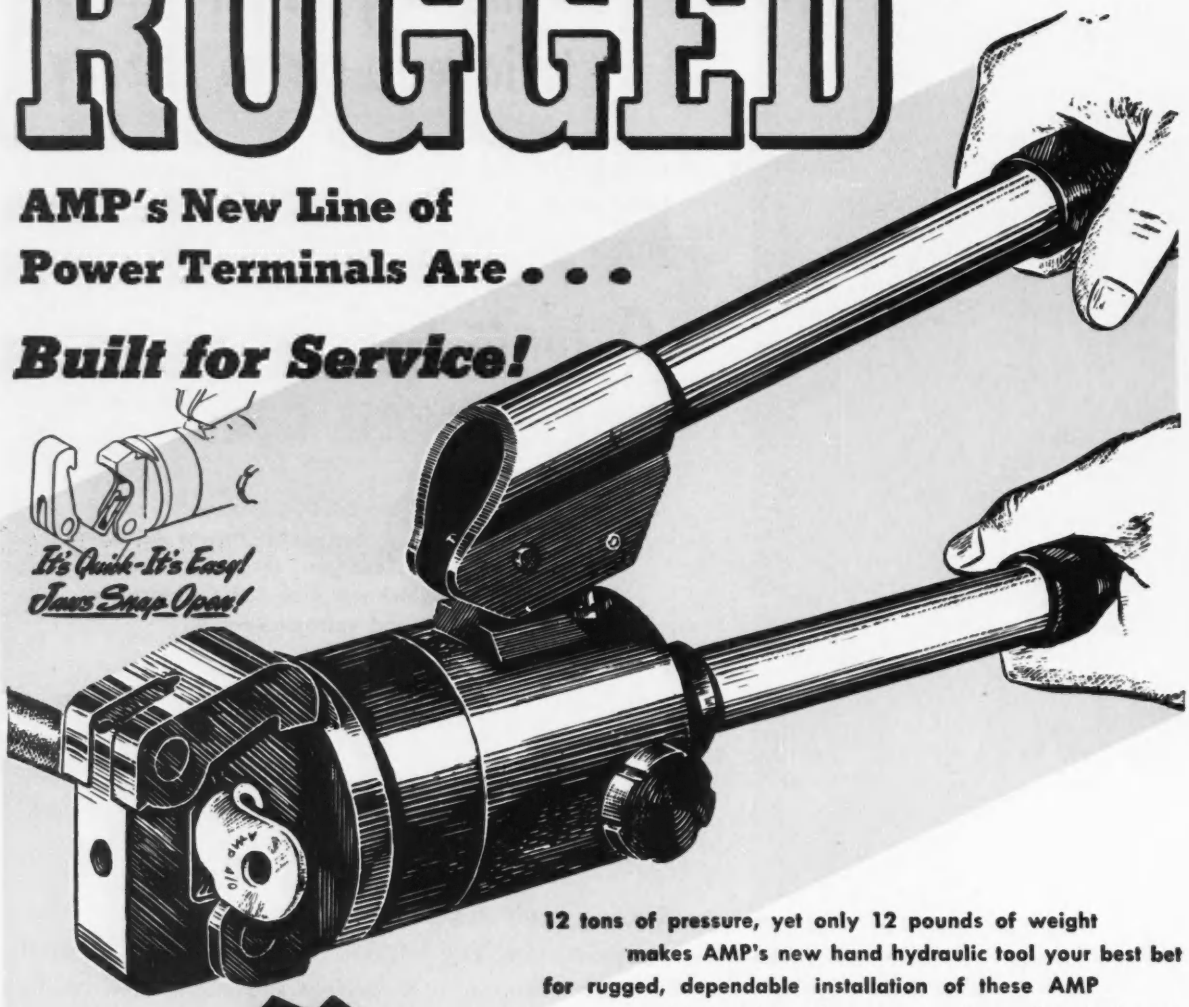
DIVISION

For complete details, consult your nearby Elliott engineer-representative, or write Elliott Company, Ridgway, Pa.

RUGGED

AMP's New Line of Power Terminals Are . . .

Built for Service!



12 tons of pressure, yet only 12 pounds of weight makes AMP's new hand hydraulic tool your best bet for rugged, dependable installation of these AMP *precision-engineered* power terminals. Terminals and connectors are available in all ranges from #8 to #4/0. DESIGNED FOR USE ON ALL SHAPES OF WIRE: SOLID, STRANDED, SQUARE, OVAL, OR COMBINATIONS! Dies snap in and out easily. Tool automatically releases when crimping pressure is reached. Can be used with either pole strap or bench stand if desired. WRITE FOR SPECIAL POWER TERMINAL CATALOG.

AMP Trade-Mark
Reg. U. S. Pat. Off.

AMP

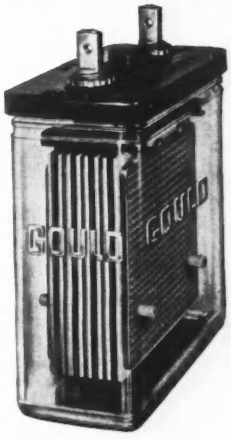
AIRCRAFT-MARINE PRODUCTS INC.
POWER TERMINAL DIVISION
2100 Paxton Street, Harrisburg, Pa.

PROTECTION

Against Emergencies . . .

THANKS TO BATTERY POWER!

With Gould Plante batteries in your battery room, operation of switchgear, telephone, signal, alarm, emergency light and power systems are perfectly protected against emergencies for years to come. These pure lead batteries have rolled up amazing service records. They're famous for their ability to deliver a powerful surge or a steady flow of current the instant it's needed . . . today, tomorrow or years from now.



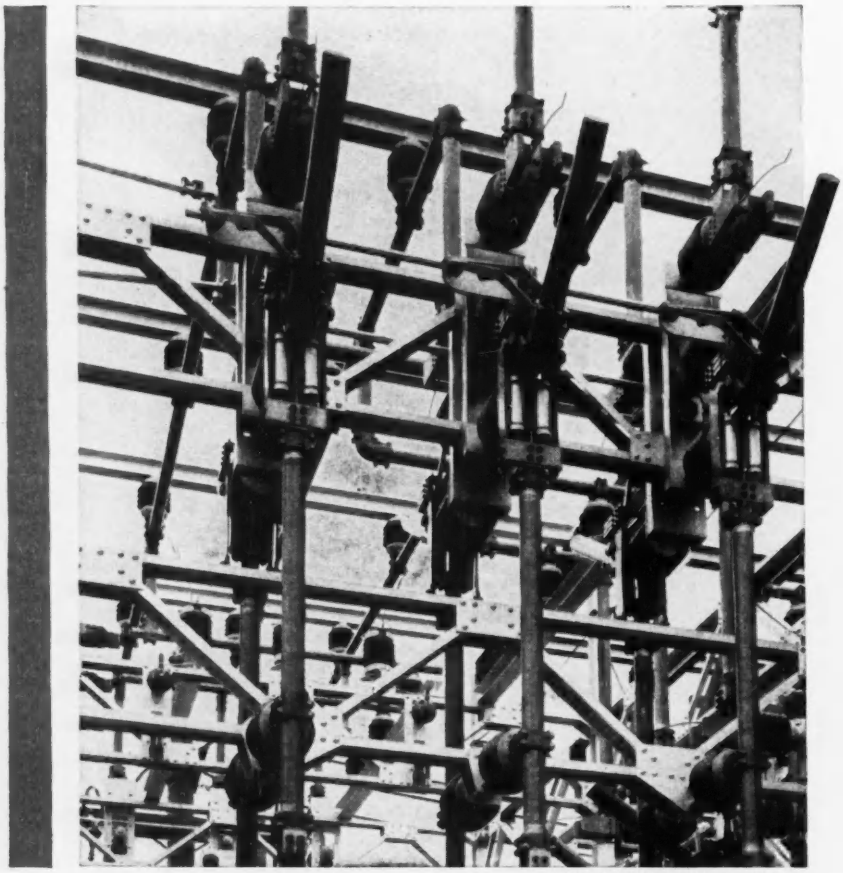
Specify
GOULD PLANTÉ—
The Aristocrat of
Stationary Batteries

GOULD *INDUSTRIAL BATTERIES*

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

©1953 Gould-National Batteries, Inc.



SCHWAGER-WOOD TYPE TA SWITCHES
23 KV, 3000 Amperes

Schwager-Wood

HIGH AMPERAGE SWITCHES

Here is a recent Schwager-Wood installation of 23 KV, 3000 ampere, group operated switches.

In these high current switches, as in all S-W switches, large or small, you can expect uniform high quality, dependability.

Prompt personal attention is given to all requests for technical information and catalogs on these switches and all other Schwager-Wood products.

SCHWAGER-WOOD CORPORATION

High Voltage Switchgear • Substation Design, Equipment • Bus Fittings, Connectors **PORTLAND, OREGON**

Technical information and prices available on request from any of our regional representatives or the home office, 8024 S.W. 35th Avenue, Portland 19, Oregon. Phone CHerry 7588

BAY CITY, MICHIGAN
P. O. Box 287
Johnson Sales Co.
Phone 3-6413

BILLINGS, MONTANA
P. O. Box 619
Victor L. Wisoki
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Walter E. Thompson Co.
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work-inspiring lighting created by GUTH * GRATELITE CEILINGS

* U. S. & For. Pats. Pend. Trademark Registered

Guth

Work is a pleasure with this velvetized light... diffused by beautiful, lattice-like GRATELITE, installed in the offices of MacKenzie, Knuth & Klein, Architects of Flint, Michigan.

data:

Room Size: 23′4″ x 9′10″ x 10′9″

Luminaires: Guth Super-Strips
12 96″ T-12 Lamps, 4500° White
Mounted on 24″ Centers, 10′6″ high

GRATELITE Ceiling: Mounted 8′6″ above floor

Foot-Candles: All Super-Strips on—86 F. C.
One-Half Super-Strips on—42 F. C.

	BRIGHTNESS READINGS:	FOOT LAMBERTS	C.P./SQ. IN.
1.	*GRATELITE Ceiling at approx. 30° Angle*	120	.260
2.	*East Wall (French Gray)*	20	.046
	Dado	13	.028
3.	*South Wall (Deep Coral)*	9½	.021
4.	*Floor (Natural Cork Tile)*	17½	.038
5.	*Desk (Chartreuse)*	36	.080

Just think: 86 Foot-Candles—and yet only 120 Foot Lambert Brightness! Never before was such low brightness with such high illumination values thought possible. Make this dream come true for you. Write on your letterhead for Catalog 905-H and GrateLite layout guide.

THE EDWIN F. GUTH COMPANY ST. LOUIS 3, MO.

Leaders in Lighting since 1902

Installation of 120-EME-17 Exide-Manchex batteries mounted on two-level rack at the Duke Power Company, Dan River plant.

Exide-Manchex BATTERIES

FOR DEPENDABLE CONTROL POWER

Outdoor circuit breaker installation at Dan River plant.

The Duke Power Company built a new large steam-electric generating plant near Leaksville, North Carolina, the Dan River plant. This plant uses Exide-Manchex batteries. They assure:

POSITIVE OPERATION: Dependable performance at ample voltage for operation of switchgear.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

Various sizes and types of Exide Batteries are available in plastic containers.

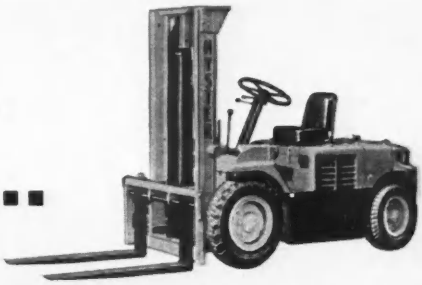
Exide-Manchex is your best battery buy for all control and substation services.

1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*

"EXIDE" and "MANCHEX" *Reg. T.M. U.S. Pat. Off.*

To all basic HYSTER TRUCKS...

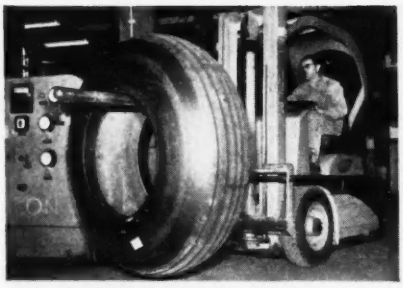


Paper-roll Load-Grab

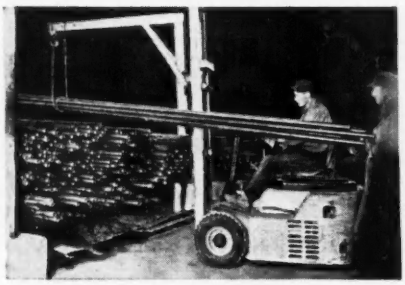
Karry Krane with Boom Extension

4-Barrel Load-Grab

Scoop—for loose aggregates.



Ram—for tires, rolls, spools, etc.



Boom—for odd shapes, light crane work.

you can add... HYSTER attachments

and do scores of jobs quicker...at less cost!

Are your materials hard-to-handle? The right Hyster® Truck Attachment — and Hyster offers more than 100 of them — frequently is the *key* to greater profits.

Whether your product is in the form of bales, boxes, bricks, barrels, buckets, aggregates, rolls or cylinders, your Hyster Lift Truck and the right attachment is the most effective answer to the problem of moving materials which cannot be handled with pallets.

Your Hyster Dealer is a specialist in reducing materials handling costs. He can recommend the correct lift truck practices for *your* materials.

Make the Hyster Lift Truck your *basic* materials handling tool—to it add the right cost-reducing attachments. Call your Hyster Dealer today, or write for Catalogs 1266, 1219, 1258 to:

HYSTER COMPANY

2947 N. E. Clackamas, Portland 8, Oregon

1047 Myers Street, Danville, Illinois

THERE'S PROFIT IN HYSTER POWER

Be Sure to Call HYSTER Before You Buy ANY Lift Truck!

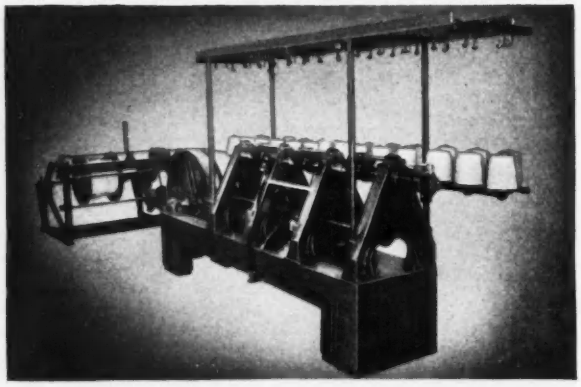
HYSTER COMPANY • FOUR FACTORIES: • Portland, Oregon; Danville, Illinois; Peoria, Illinois, Nijmegen, The Netherlands

More and more, leading wire manufacturers the world over are proving the advantages of the *Fidelity Sinfra Knitter.**

With each new installation the *Sinfra* establishes —time after time—its ability to cover wire faster and more economically than any other method.

Today, the list of *Sinfra* users includes the world's foremost manufacturers of Wire and Cable.

Why not prove for yourself the outstanding advantages of this amazing machine? Write today for Catalog W-1 or visit the new show rooms at our plant.



*Approved by Underwriters' Laboratories, Inc., American Standards Association, Association of American Railroads, Canadian Standards Association, and Federal Specification J-C-145.

Designers and Builders of Intricate, Automatic Precision Machines

SINCE 1911

FIDELITY MACHINE COMPANY, INC.

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READ THIS AMAZING

Pin Type Insulator

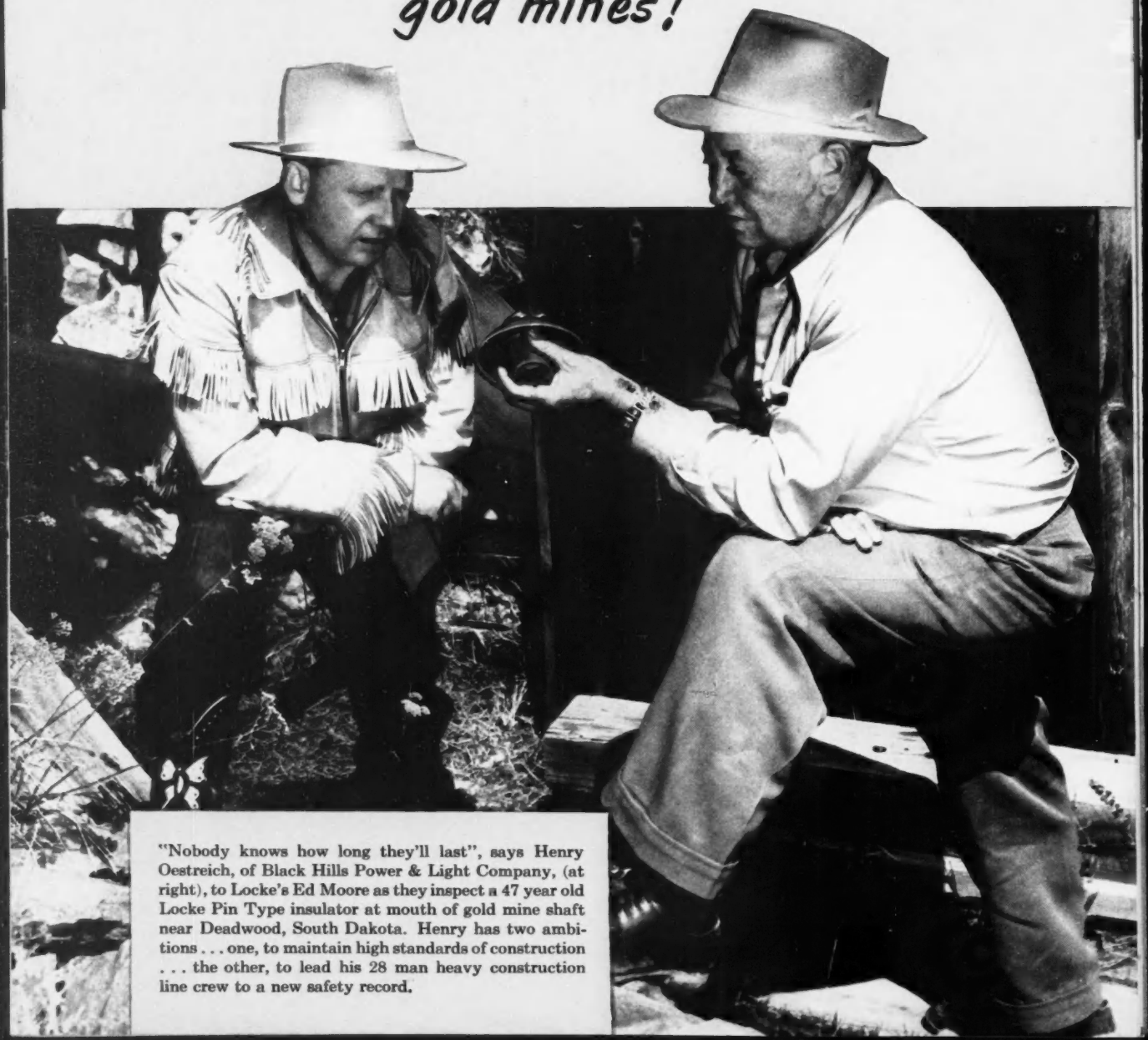
Service Record Report

from the

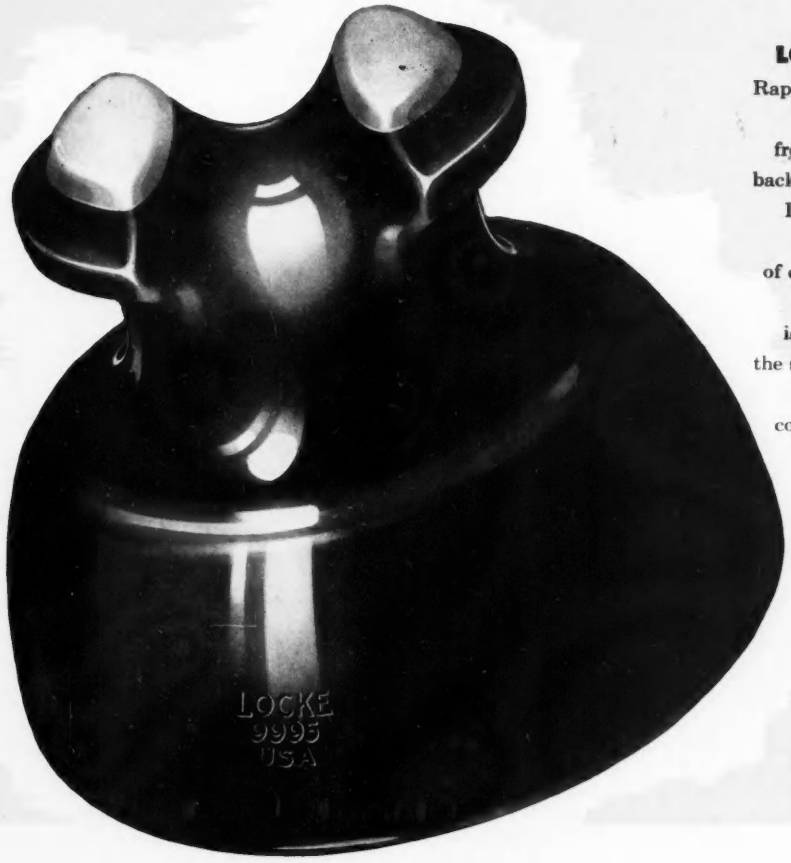
Henry Oestreich, Constr. Supt.
Black Hills Power and Light Company
Rapid City, South Dakota, says—

"Locke Pin Type Insulators so good we re-used them, even after 47 years continuous service

...at Rattlesnake Jack 'n Kickin' Horse gold mines!"



"Nobody knows how long they'll last", says Henry Oestreich, of Black Hills Power & Light Company, (at right), to Locke's Ed Moore as they inspect a 47 year old Locke Pin Type insulator at mouth of gold mine shaft near Deadwood, South Dakota. Henry has two ambitions . . . one, to maintain high standards of construction . . . the other, to lead his 28 man heavy construction line crew to a new safety record.



LOCKE'S ED MOORE reports from Rapid City, S. D., "In the Black Hills of South Dakota temperatures can zoom from 20° below zero to 60° above—and back again in 10 minutes! The ability of Locke Pin Types to withstand such thermal changes over a 47-year period of continuous, uninterrupted service reflects the supreme quality which is built into *all* Locke Insulators—from the smallest spool to the largest bushing. No wonder leading utilities place their confidence in Locke Insulators."

"You can't beat that for insulator performance," says Henry Oestreich, as he relates the facts of this amazing service record to Ed Moore.

Says Henry: "Back in 1905 my company put in lines to the Rattlesnake Jack'n Kickin' Horse gold mines.

"They're over in the Black Hills . . . right outside of Deadwood.

"That's the town where Jack McCall killed Wild Bill Hickok with a shot in the *back* of the head while Wild Bill was looking the other way . . . at his poker hand. And, it's where an old gal named Poker Alice took the boys real good at faro in the bar of the old Bodega cafe.

"Anyway, these lines to the Rattlesnake and Kickin' Horse stayed in continuous service 'til early last year when they were torn down.

"None of the material used to build those lines was of any value . . . except these Locke Pin Types which had been in continuous service since 1905. That's 47 years—the way I make it.

"They looked so good we checked 'em over, cleaned 'em up a little and decided to re-use 'em rather than junk 'em. So they're now in service again on the re-build of our Pluma-Nemo 12 kv line.

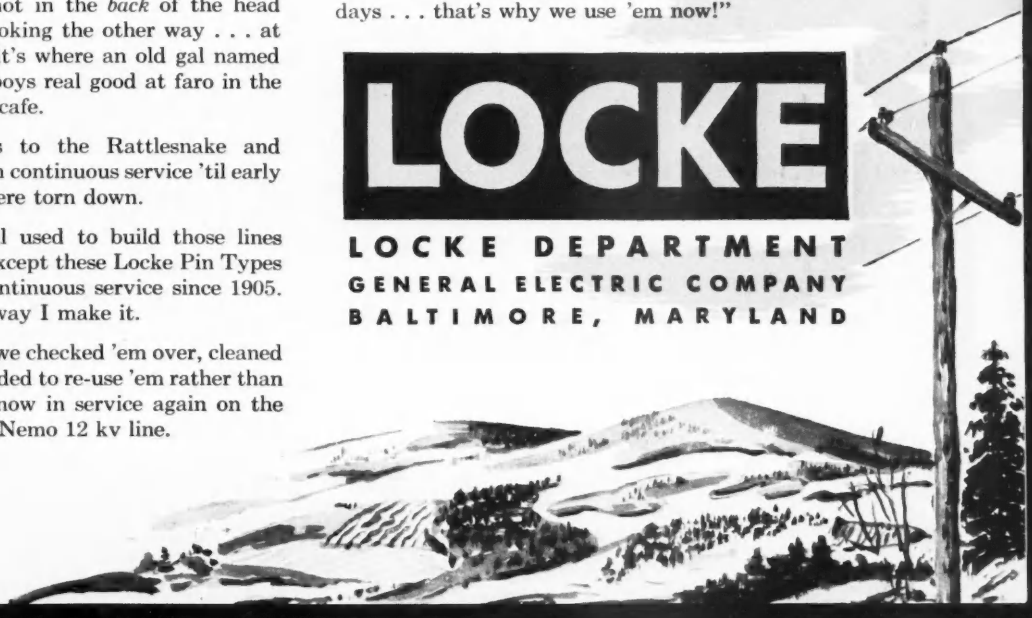
"But that's not the whole story. If you looked around our system you'd find a lot more of these old Locke Pin Types still in service on some of our company's original lines which are still in existence.

"You can't beat that for performance, can you?

"But it's the kind of performance we've got to have," says Henry, " 'cause during the winter it's tough to get through the snows up there in the Hills to maintain our lines. So, we've got to have nothing but the best construction all the way through. That's why we used good insulators **back in the old** days . . . that's why we use 'em **now!**"

LOCKE

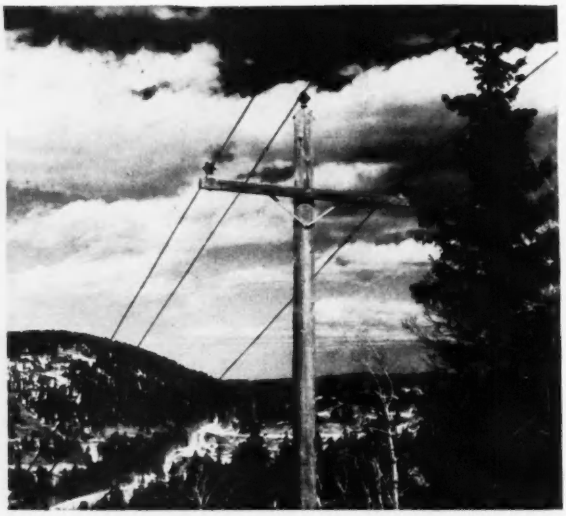
LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND



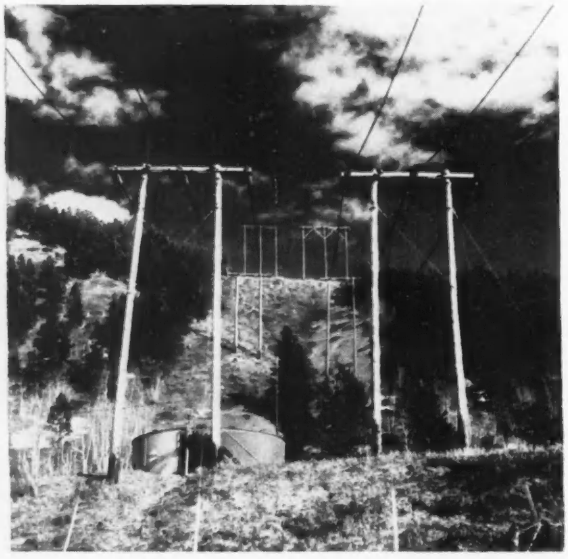
Typical Operating Conditions

of Black Hills Power and Light Company, with headquarters in Rapid City, South Dakota

In mountain and prairie areas served by the Black Hills Power and Light Company, temperatures can drop from 60° above to 20° below zero . . . in ten minutes. Obviously, only the finest equipment can withstand such drastic thermal changes. Locke Pin Types have been doing just that for 47 years!



12 kv line stretching east from Terry Peak, famous ski resort 6,500 feet high in South Dakota's original hunting grounds of the Sioux Indians—the Black Hills. All three insulators in foreground are Locke Pin Types . . . put in service in 1905 . . . and still on the job!



69 kv line from company's Deadwood plant to Custer, South Dakota, 60 miles away, and to Osage, Wyoming, about 50 miles. Note combination of two-pole deadend, two-pole suspension and three-pole deadend. Many holes had to be dynamited seven feet into solid rock . . . a typical example of construction difficulties encountered in the Black Hills.

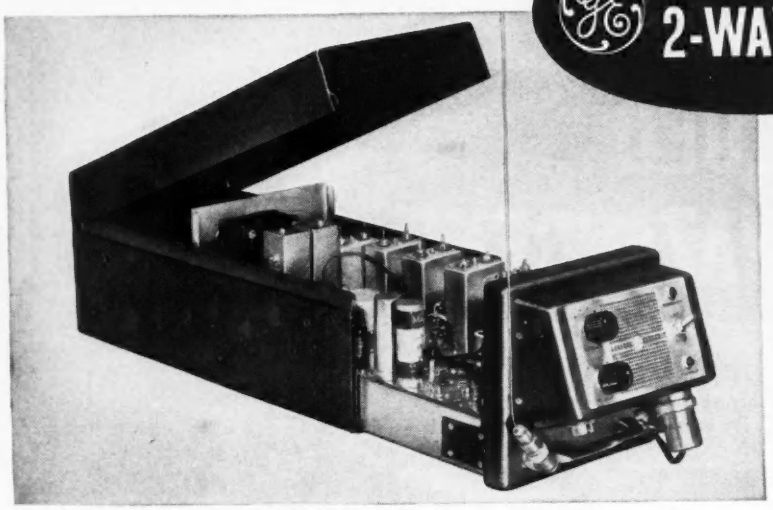
These are examples of the rugged terrain and tough climate under which Locke Pin Type Insulators established a 47 year record of continuous service—probably an all-time record!

No wonder leading utilities put their confidence in LOCKE Insulators.

General Electric Announces a

NEW ADVANCED 2-WAY RADIO DESIGN

Low Power Industrial
2-WAY RADIO



Remove just 4 screws . . . control head is dismounted for flexibility of application!

- **Lowest current drain in standard use today!**
- **6/12 . . . 28 to 40 . . . or 117 volt operation!**
- **Mobile units are interchangeable with station equipment!**
- **Adds multiple new applications!**
- **Extremely compact!**
- **Sensitive . . . selective . . . has clear, crisp audio!**
- **General Electric engineered for the materials handling function!**
- **Weather resistant!**

THE basic intent behind General Electric development of this new mobile unit is to enhance the value of radio in your industry's operations. In it you see features that are head and shoulders above all other low power industrial radio equipment. With it your work will be performed faster and better *regardless of your business requirements!* Whether you want more miles of pipeline serviced . . . more crops harvested at the right market time . . . more emergencies avoided or solved . . . or more customers served . . . you will get more industrial productivity at lower cost than ever before. In these and many other fields G. E. has opened new, broader avenues of radio application! Investigate its advantages to you today!

YOUR CAS* MAN...
has complete information on the new LPI equipment. Take advantage of the service he offers at a local G-E office today or send us this coupon!

Communications Advisory Service

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

General Electric Company, Section 19113-16
Electronics Park, Syracuse, New York

Please send me the new G-E LPI Radio literature describing features and specifications.

NAME.....

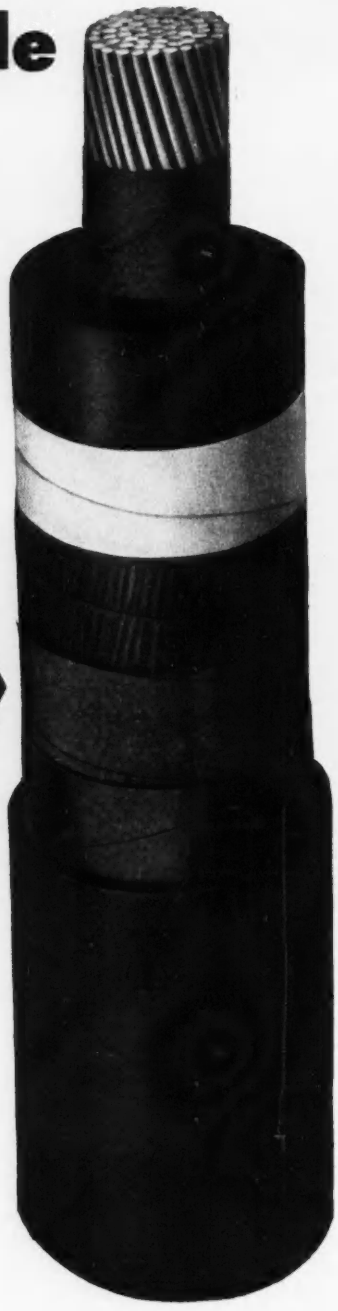
COMPANY.....

ADDRESS.....

CITY.....STATE.....

GENERAL ELECTRIC

for High Voltage Cable be safer... be surer with



SHIELDED KEYSTONE-HAZAPRENE

Shielding of electrical cables at voltages over 5000 volts is now generally recommended. By equalizing voltage stresses and preventing the formation of corona, shielding guards the life of the rubber insulation. It also prevents surface discharges, thus protecting men who handle the cable.

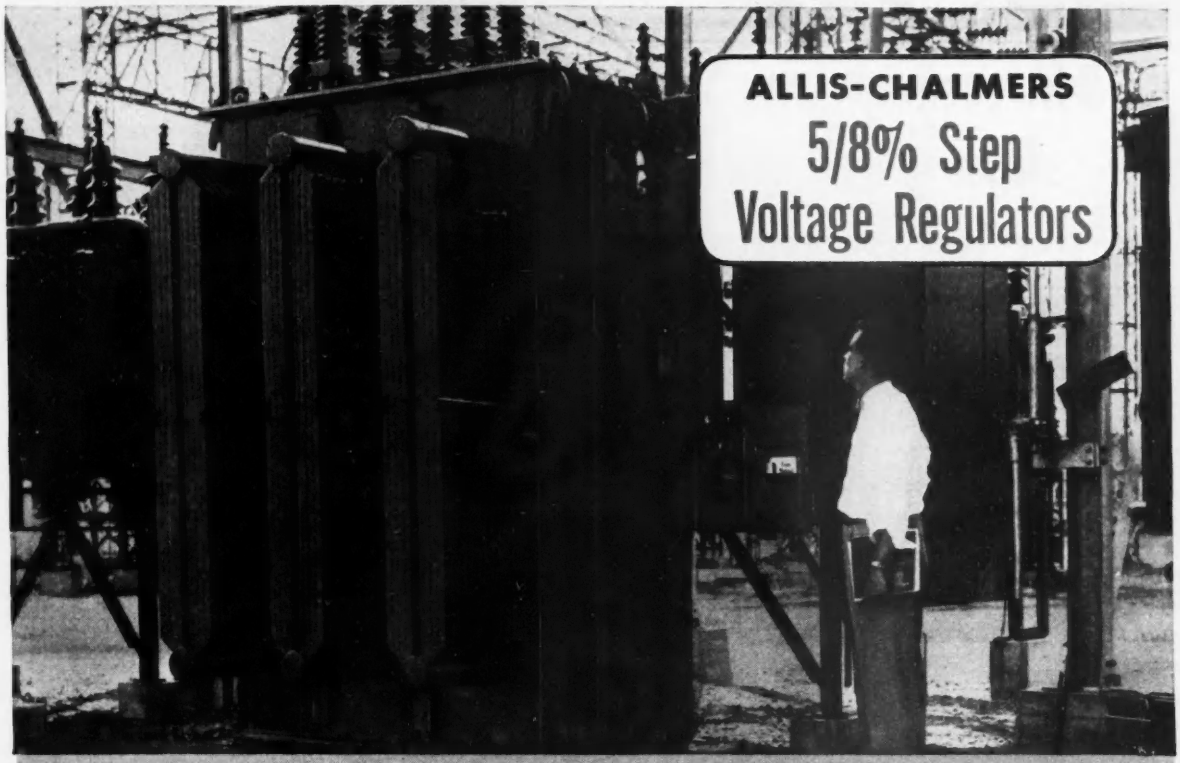
One of the important advantages of Shielded Keystone-Hazaprene over other such cables is in the controlled application of the copper shielding tape. In Shielded Keystone-Hazaprene this tape—as well as the auxiliary paper and cable tapes—is applied with constantly controlled tension, the most successful means of preventing undesirable physical stresses within the cable. Case histories have proved the proper application of shielding tape to be a very important factor in the service life of high voltage rubber-insulated cable.

This exclusive Hazard feature, combined with the toughness of the mold-cured Hazaprene sheath and the stability of the Keystone insulation, provides a high degree of dependability, long service life and operating economy.

For transmission and distribution circuits, generator and transformer leads, test leads and similar uses, you'll use shielded cable for 5001 volts and up. And to protect personnel and vital electrical circuits, be safer and surer by specifying Shielded Keystone-Hazaprene. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

HAZARD *insulated cables*

1954



Simple Design Reduces Costs of Three-Phase Voltage Regulation

The simple design of Allis-Chalmers three-phase power regulators means you get highest quality regulation with an absolute minimum of maintenance. You get ± 1 volt band, Class I accuracy, 20% range of regulation, and many famous Allis-Chalmers features that cut costs.

Unit Construction Reduces Maintenance

Thanks to unit construction, there are 78 fewer connections than with other designs. And all connections can be made before the unit is tanked. Untanking for future inspection is especially easy — just remove cover and control cabinet bolts, and lift entire regulator from tank.

Feather-Touch Control Easy to Operate

You save maintenance time with Allis-Chalmers voltage regulators because the *Feather-Touch* control has fewer operating components than any other regulator control. Operation is easy because control components are calibrated. Voltage band and voltage level can be set in less than a minute.

Quick-Break Tap-Changing Mechanism

Fast, efficient tap changing without shock, thanks to the balanced spring operation of the *Quick-Break* tap-changing mechanism, makes contacts last longer. Mechanism operates entirely under oil — there are no adjustments to make, nothing to lubricate.

It pays to get all the facts. Contact your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

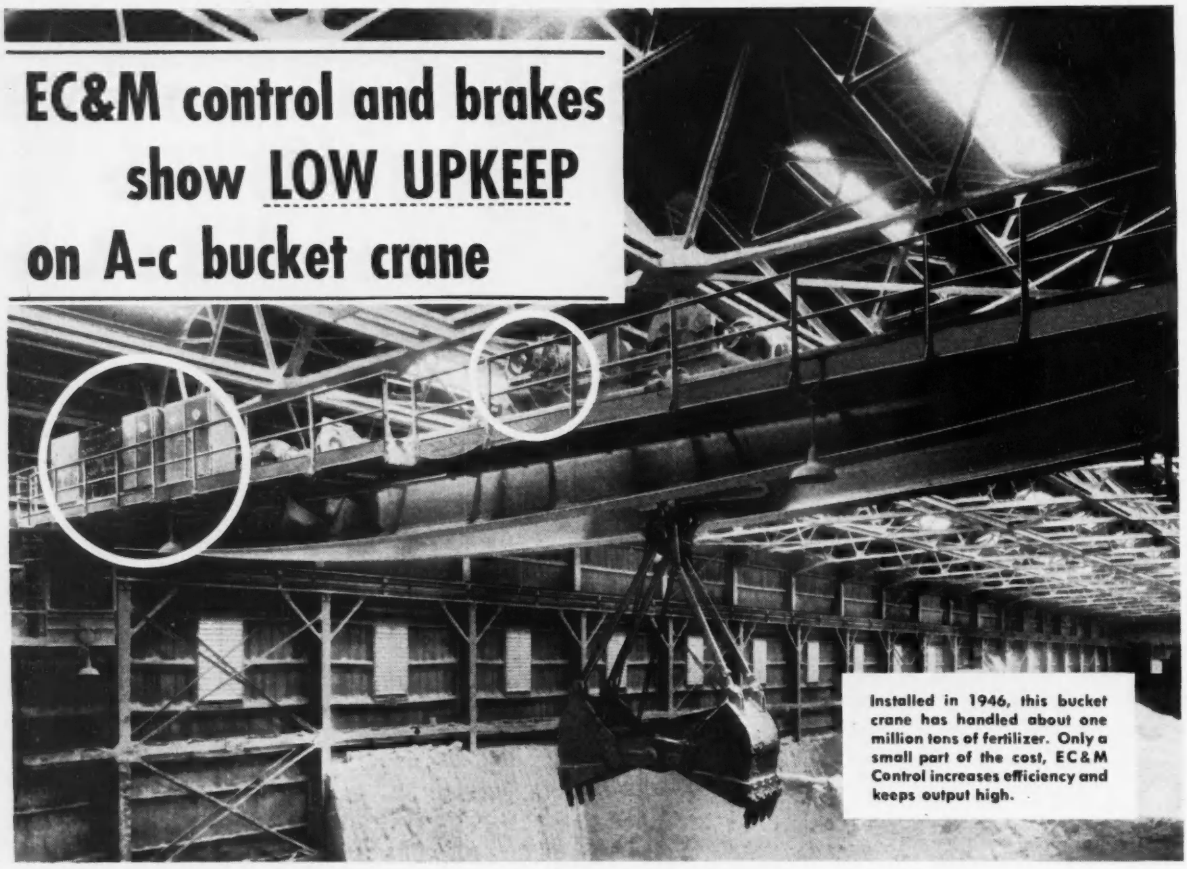
A-4128

Ratings Available	Through 2500 Kva Up to and Including 69 Kv

ALLIS-CHALMERS

Originators of ⅝% Step Regulation

EC&M control and brakes show LOW UPKEEP on A-c bucket crane



Installed in 1946, this bucket crane has handled about one million tons of fertilizer. Only a small part of the cost, EC&M Control increases efficiency and keeps output high.

RENEWAL PART Cost only $1.40 per 1,000 tons of fertilizer handled during 7 years of operation.

Sounds good and is good—but read the complete story of how EC&M Control Apparatus has given almost perfect service . . . operating 12 hours a day throughout nearly 7 years on this A-c bucket crane in an eastern fertilizer plant. EC&M Controllers and Type WB Brakes have required few replacement parts. Maintenance has been on a routine basis during normal idle periods. EC&M Type WB Brakes and EC&M Frequency Relay Control have operated with *no production delay in 7 years.*

This is typical of the performance of EC&M Control Apparatus on every type of material-handling crane. Cab-operated or floor-operated; a-c or d-c motored. Before buying cranes, contact our nearby office for recommendation on control that will promote high-speed production at low upkeep. It pays to specify EC&M Control for cranes.

NEVER HAD IT SO GOOD!

EC&M LINE-ARC Contactors are known for low upkeep

1. No destructive arc shield burning in 7 years—only 3 broken shields replaced.

2. 14 contactor coils have operated continuously with only one replacement.

3. Contacts renewed on an average of once a year on one size and once every two to three years on the other size. No replacements on largest size contactor.

EC&M WB Brakes solve the A-c Brake Problem*

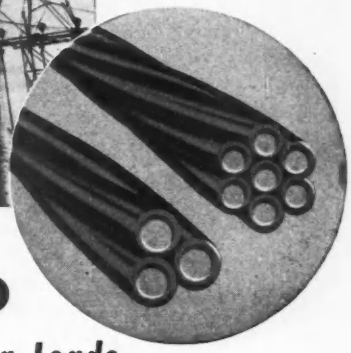
1. Brakes relined on an average of every 18 months.

2. Not a single brake-coil failure.

*Fast-releasing—fast-setting—no chatter, hum or hammer.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

POWER LINES ARE BUSY IN FLORIDA . . .



Copperweld Wire and Strand are permanently protected against corrosion. Each wire has a thick copper covering inseparably Molten-Welded to a strong alloy steel core.

Live Wire Utility Uses Non-rusting Copperweld® STRAND *To Support Increasing Loads*

Florida's rapid growth during the past 20 years has been little short of phenomenal. For example—population has more than doubled and industrially it is growing even faster, the number of manufacturing firms having increased 100% in the last five years.

To supply vital electric service for this expanding population growth, Florida Power & Light Company is constantly enlarging its facilities. Since VJ-Day alone, FP&L has nearly tripled its generating capability, built 4,837 miles of new lines to serve 207,630 new customers. Plans call for tripling its service within the next 10 years.

Since 1932, Florida Power & Light Company has used non-rusting Copperweld* Guy and Messenger Strand for dependable, economical overhead line construction. This progressive utility has found that once Copperweld is up, it's up to stay.

Today, in all parts of the world, many power companies, railroads and communication systems are relying on Copperweld Wire and Strand to give their overhead lines permanent, trouble-free operation at lowest annual cost. That's because each Copperweld Wire has a thick copper covering which permanently protects the high-strength steel core against rust and loss of strength. Thus, maintenance and replacement costs are eliminated; maximum continuity of service is assured.

Write us today for your copy of the Copperweld Engineering Data Book.

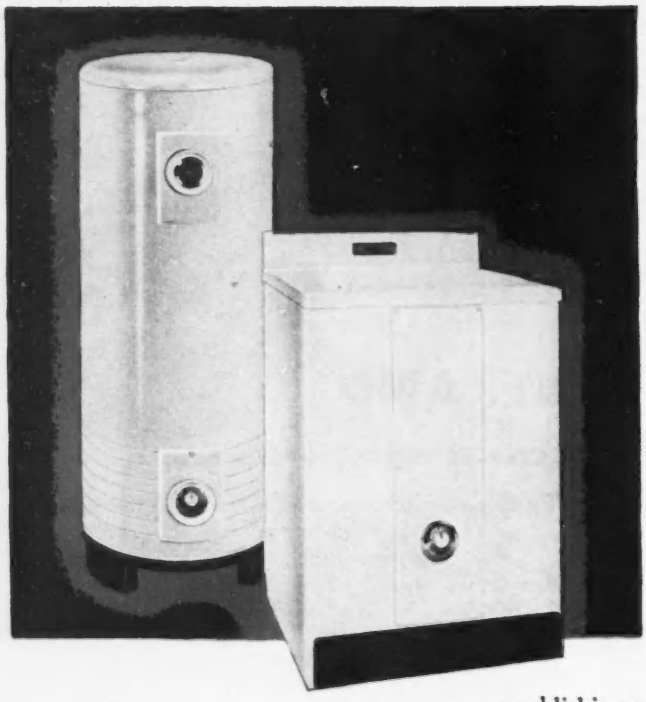
*Trade Mark

COPPERWELD STEEL COMPANY
Glassport, Pa.
SALES OFFICES IN PRINCIPAL CITIES

Copperweld® NON-RUSTING
GUY AND MESSENGER STRAND

Hotpoint

Automatic Electric Water Heaters



Build Greater Demand For Electric Water Heating—Thus, Greater Revenue for Utilities!

Hotpoint pioneered the electric water heater and has produced more than one-third of all those in use today . . . over one million. Features developed by Hotpoint for more efficient heating of water have been a strong factor in establishing today's demand for electric water heaters.

Hotpoint's Electric Water Heater Line, a full range of sizes in round and table-top models, offers a water heater for every domestic need. Hotpoint's famed MAGIC CIRCLE® heat with Calrod® heating units provides one of the most rapid methods of heating water. Have your Hotpoint distributor give you the complete story on the revenue potential that Hotpoint Electric Water Heaters provide today—and in the years ahead.

Again Hotpoint looks at Tomorrow, Today

POWERS *American*

SERIES HD-1

Fully-Powered

HYDRAULIC DERRICK

- LIVE BOOM — CAN BE OPERATED UNDER LOAD
- INFINITE OPERATING POSITIONS
- REQUIRES ONLY SINGLE-DRUM WINCH
- LIFTS LOADS TO BODY PLATFORM
- NO CENTER LEG TO OBSTRUCT BODY CARGO AREA

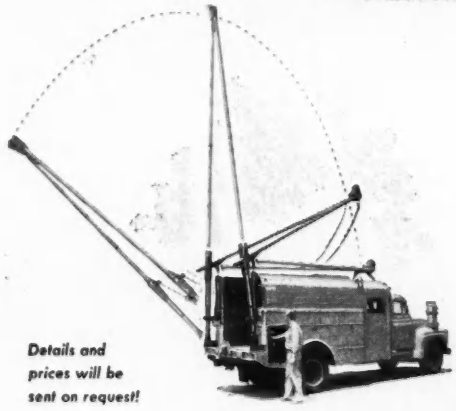
"The Accepted Standard with Utilities Everywhere"

Operation of the Series HD-1 derrick is *completely hydraulic.* It is raised to working position, elevated or lowered to desired height, and returned to carrying position . . . hydraulically.

There is no mechanism to endanger workmen — no center leg to obstruct the body cargo area — no manual operation, other than insertion and removal of locking pins, and shifting of hydraulic control levers.

This is a *heavy-duty* derrick which will handle poles up to 55 ft. in length — under the most severe operating conditions.

Capacity, with head sheave 5′ to rear of body, is 6000 lbs. When extended to 14′, capacity is 2500 lbs.



Details and prices will be sent on request!

THIS IS A "*Live Boom*" DERRICK

There are no pre-determined "stops" to limit operation of the derrick. It can be spotted in an unlimited number of positions, and moved at any time — even while supporting a full load.

Twin hydraulic rams raise the derrick from carrying position to working position in less than a minute. When derrick is spotted, a poppet-type control valve seals oil in cylinders to prevent "kick back" or "creeping".

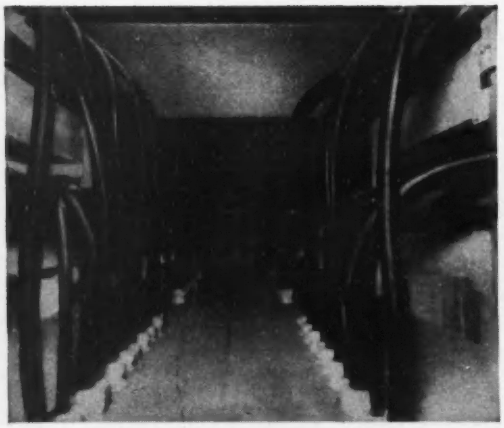
POWERS-AMERICAN DIVISION

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO.
428 LATHAM SQ. BLDG. • OAKLAND 12, CALIF.

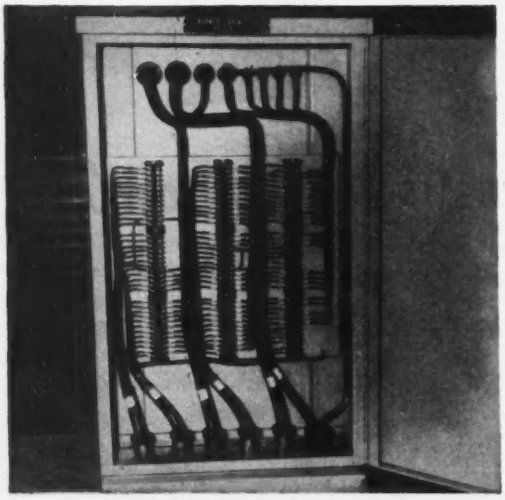
A progressive approach to cable engineering pays off...

Rome cables chosen

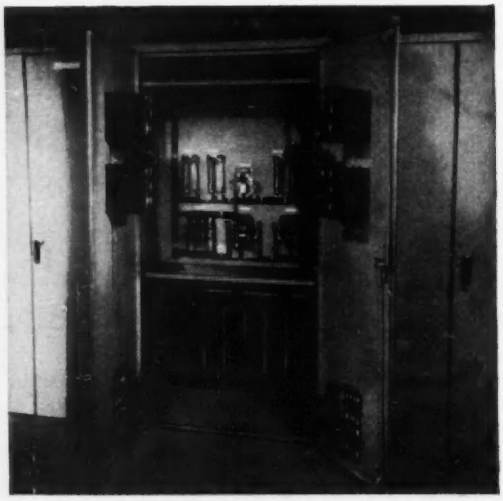


Steel cable racks above relay cabinets. Glossy cable surfaces make Rome cables easy to install.

Power board No. 11, typical of control panels throughout the station.

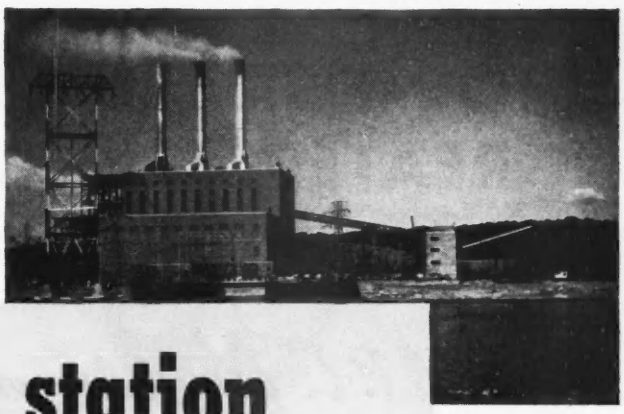


Burner cabinet No. 2 for boiler No. 2. Note Rome thermoplastic control cables permit compact installation.



Typical relay cabinet for unit No. 2. Note neatness of installation afforded by Rome control cable.

GLENMONT STATION of Niagara-Mohawk Power Corporation is designed to supply electrical energy for a wide area, including Rome, Utica, Troy, Amsterdam, Canajoharie, Schenectady and Albany itself. Located along the Hudson River, it is the last word in power generating efficiency. Total rated capacity, when completed, 320 m-w.



for new Albany station

When utility engineers consider cables for their station planning, they thoroughly investigate available cable constructions from the standpoint of reliability, handling qualities, and neatness of appearance after installation. This was the case when Niagara-Mohawk Power Corporation engineers studied conditions connected with two recent station installations. And they found that Rome cable met these specifications.

There are many miles of Rome cable in the new Glenmont Station of Niagara-Mohawk now nearing completion near Albany, N. Y. Rome cables were also used in their Dunkirk Station, completed in 1951.

Four 80 m-w units are involved at Glenmont with provisions for further additions. Nearly 110 miles of Rome control cable and over 41 miles of Rome power cable have been supplied for this station.

CONTROL CABLES

The control cables are insulated with RoLene (polyethylene) and jacketed with Rome Synthinol. RoLene is practically unaffected by water, dc electro-osmosis, and low temperatures. It resists most chemicals, oxidation and oils.

The tough protective sheath of Rome Synthinol provides exceptional resistance to moisture, corrosion, abrasion and flame. Its aging characteristics assure long life under severest operating conditions.

POWER CABLES

The power cables are insulated with RoZone and jacketed with RoPrene (Neoprene). A premium quality oil-base type of insulation, RoZone exceeds all requirements of ASTM specification D-574 assuring unquestioned dependability. It is resistant to corona action and aging. It shows high stability in water and possesses excellent electrical characteristics. As a further safeguard, every foot of power cable rated at 3000 volts and over is subjected to ionization testing as a standard manufacturing control. This test assures less maintenance problems.

VERSATILITY COUNTS

All Rome thermoplastic station control cables are adaptable to installation requirements. They may be installed in ducts, trays, or on racks—or used in circuits combining all these installation methods. They are recommended for operating temperatures up to 75° C. Versatility is one of the reasons underlying the preference of utilities, consulting engineers and industrials for Rome power and control cables.

(Left) Rome station control cable with RoLene insulation and a Rome Synthinol sheath . . . designed for installation in ducts or in air.

(Right) Rome power cable with RoZone insulation and RoPrene sheath . . . designed for installation in ducts or in air.

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DROP-FORGED for GREATER STRENGTH

BTC

M.P.L. Aluminum

SUSPENSION CLAMP

for A.C.S.R.
and All-Aluminum Conductors

MINIMUM POWER LOSS

INCREASED CONDUCTOR LIFE

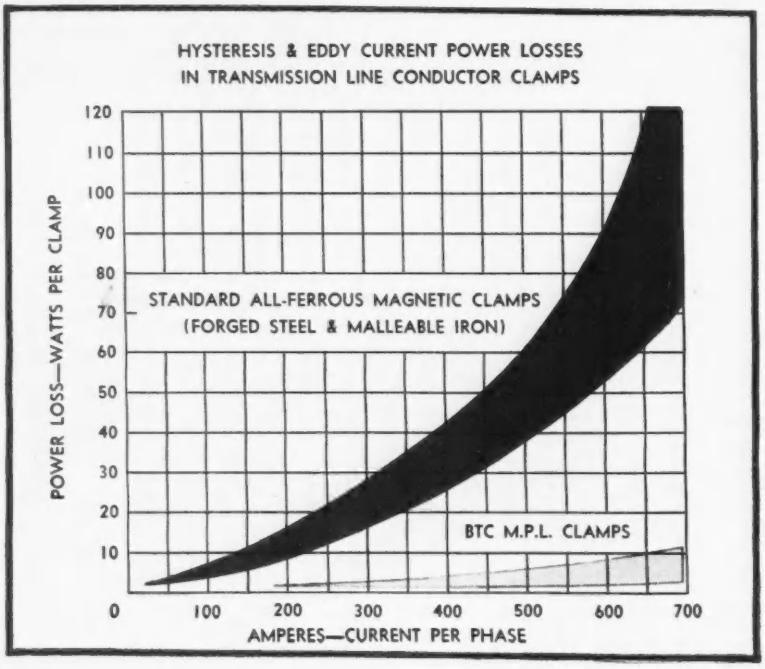
STRONGER

MPL MINIMUM POWER LOSS

The use of non-magnetic Aluminum Alloy Clamp Body reduces eddy current and hysteresis losses to a minimum . . . prevents temperature rise in the clamped section of the conductor, which will operate at lower temperature than in the span.

CONSIDERABLY STRONGER

Forgings, in any metal, are employed where better strength, soundness and finish are required than can be obtained by other processes. Forging produces a fine, close-grained structure, with the grain flow following the contour of the part and with optimum mechanical properties and ability to withstand severe loading, sudden shock and frequent reversal of stress.

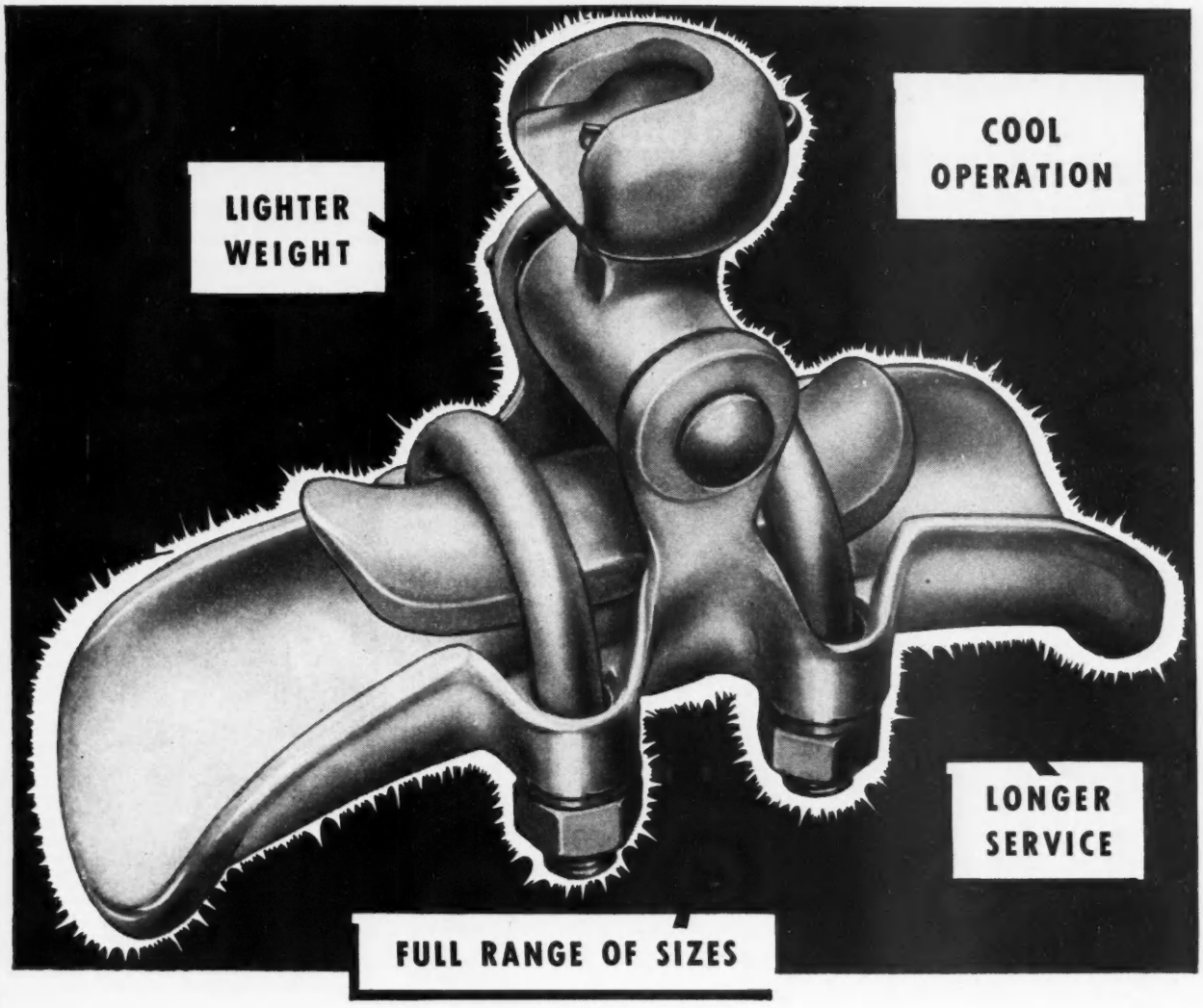


The BTC Clamp Body is FORGED Aluminum alloy, the strongest recommended for the purpose, fully heat-treated to develop maximum mechanical properties.

In the heat-treated condition, the ultimate strength and hardness is more than twice . . . and the yield strength and endurance limit more than three times . . . that of alloys used in other processes. The more-than-adequate catalouged strength ratings of BTC Clamps are conservative and are exceeded in actual tests.

LIGHTER WEIGHT

Heavy sections or reinforcing ribs, necessary in other materials to develop desired strength and prevent collapse or breakage of the clamp under clamping U-Bolt pressure, are not required in forged clamps. Undesirable weight is eliminated without sacrifice of strength.



INCREASED CONDUCTOR LIFE

The light weight and generous longitudinal radius of the conductor seat minimize the effects of conductor vibration. The conductor is not bent over a small radius at any point.

Clamping pressure is greatest at the center, gradually decreasing toward each upswept end of the keeper. Clamp and Keeper ends are liberally bell mouthed and beaded to prevent conductor damage and formation of corona.

The conductor is fully supported in the clamp body. There are no open pockets at U-Bolt holes to allow distortion of the conductor under clamping pressure.

LONGER SERVICE

The superior strength insures against failure under severe loading. The greater hardness prevents excessive wear at points in contact with the supporting pin.

The close-grained, non-porous structure of the forged clamp body effectively prevents the destructive internal seepage of corrosive elements, a cause of failure in some transmission line fittings produced by other processes.

FULL RANGE OF SIZES

BTC offers a choice of exactly the right clamp for each size of A.C. S.R. or all-aluminum conductor. The close dimensional fidelity of the die-forged and die-formed parts makes unnecessary any bore size allowance for manufacturing variations in the clamps.

Specify BTC MPL Aluminum Suspension Clamps from your insulator manufacturer. They are an important part of BTC's complete line of forged transmission line hardware.

Sold Through Your Insulator Manufacturer Only

Drop Forged **BTC** *Hi-Line Hardware*

The BREWER-TITCHENER Corporation

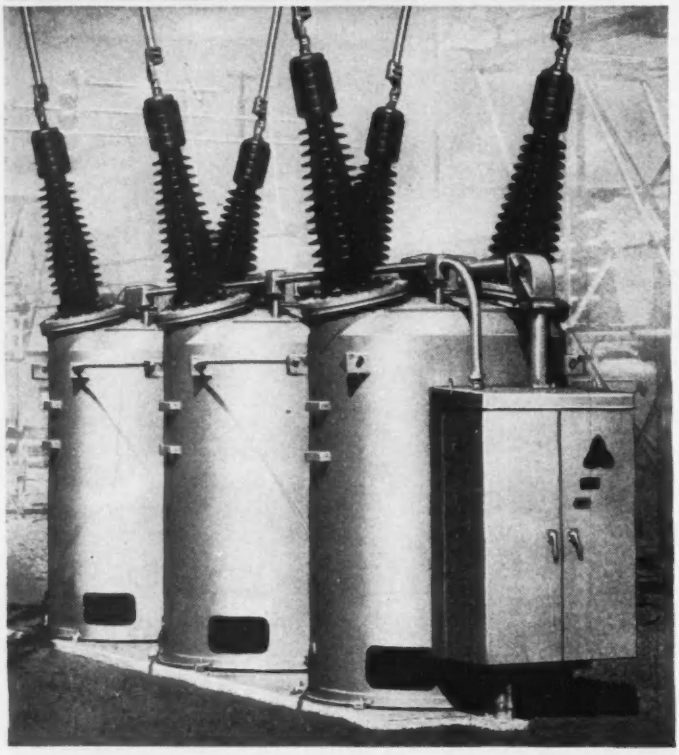
Cortland • New York

Advanced Protection for Present and Future Loads

PACIFIC ELECTRIC
Type RHE
CIRCUIT BREAKERS
ASA, AIEE, and NEMA STANDARD

Projection of load growth and of maximum fault current may indicate the selection of breakers of far higher rating than present load requires.

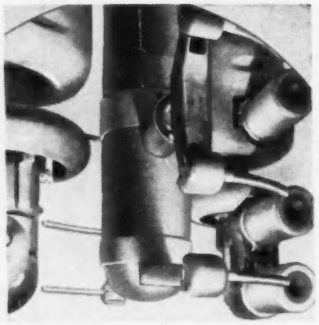
115, 138, 161 kv — 3 or 5 cycles
196/230, 230, and 287 kv — 3 cycles
to 10,000,000 interrupting kva (ASA)
at 161, 230, and 287 kv

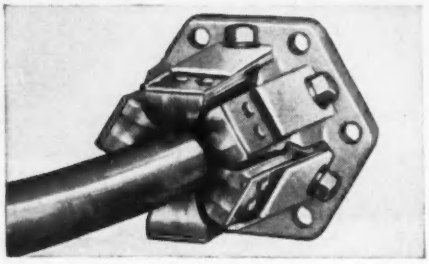


At Left:
One of Fifteen Type RHE-78, 161 kv, 10,000,000 int. kva for Electric Energy, Inc., Joppa, Illinois.

At Right:
Interior of Tank; a single rotary structure connects six interrupters in series (three are shown).

Below:
Moving Contact Entering Nest of Six Sliding-Shoe (finger) Contacts.





These features contribute to Pacific's Proved Protective Performance . . .

Nested Sliding-Shoe Contacts

PACIFIC'S Continued use of the reliable nested sliding-shoe (finger) form of contact, even for the largest circuit breakers, is now supported by the industry trend when severe conditions are to be met.

The stationary and moving contact surfaces of the contacts are silver Elkonite, of such form that arc foot prints are confined to portions of the surfaces that do not carry load current.

The stationary contact structure of each pole comprises six sets of contacts in series, each of either four or six shoes, depending on rating. Voltage division between the sets of contacts is aided by capacitance grading shields.

Proved Interrupters

Pacific interrupters are of simple self-pressurizing type; their exceptional performance is due to improved utilization of directed oil flow and to high speed of developing open-gap distance.

Other Features

- Only one moving structure within the tank.
- Opening accelerating springs and shock absorbers are outside of the tank.
- Oil-hydraulic restoration of closing energy.
- Easy manual emergency operation for load switching as well as for test.
- Electrically and mechanically trip free in any position, even during high-speed reclosing.

Since 1906

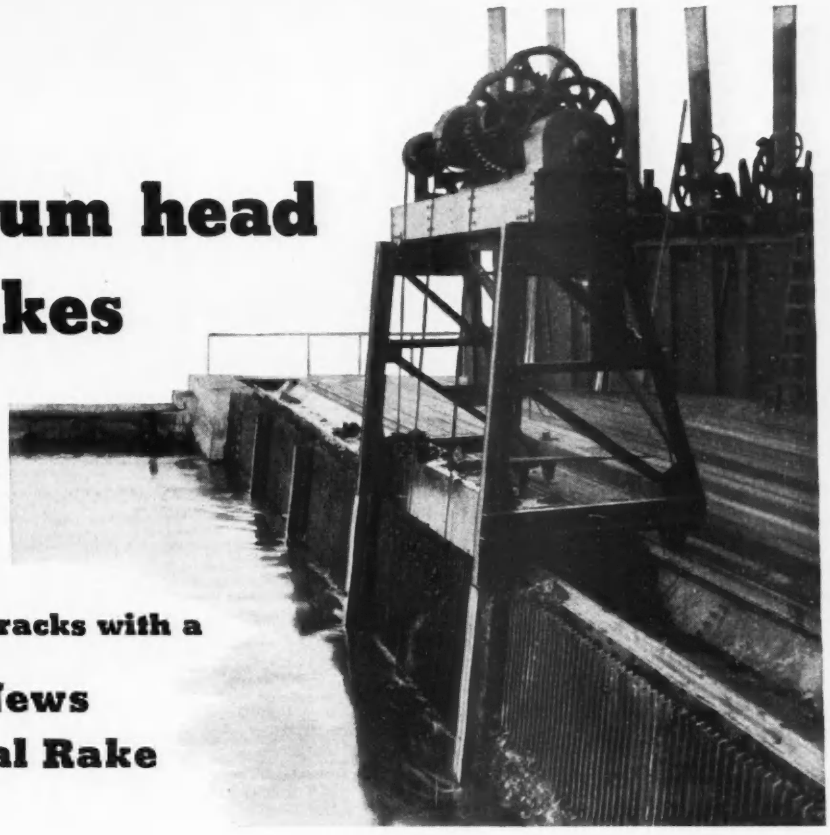
SALES OFFICES or AGENCIES
in PRINCIPAL CITIES

PACIFIC ELECTRIC
• MFG. CORPORATION •

SUBSIDIARY OF FEDERAL ELECTRIC PRODUCTS COMPANY

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA
OTHER FACTORIES: SANTA CLARA, CALIF.; SCRANTON, PENNA.

Gain maximum head at Intakes



...by cleaning your racks with a

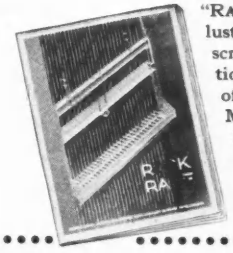
Newport News Mechanical Rake

Keeping racks clean is essential wherever a few inches of head loss can reduce output of the wheels.

One company calculated the capitalized value of each inch of head gained at its plant as $6,000. Measured in terms of the value of additional power output, a Newport News rack rake installed at this plant is paying for itself over and over again the year 'round.

Power-operated to clean trash racks at water intakes of hydroelectric plants, steam plants, pumping stations, canals and similar installations, the Newport News Mechanical Rack Rake reduces a major hand-labor task to one of minor periodic activity.

Under ordinary conditions, one man per shift can, with a Newport News Mechanical Rack Rake, keep the racks clean for a dozen bays.



Write for your copy of "RACK RAKE," an illustrated booklet describing the operation and advantages of the Newport News Mechanical Rack Rake. Use the convenient coupon now.

NEWPORT NEWS
Shipbuilding and Dry Dock Company
Newport News, Virginia

Newport News Shipbuilding and Dry Dock Company
Dept. EW-11-16, Newport News, Virginia
Please send me a copy of "RACK RAKE."

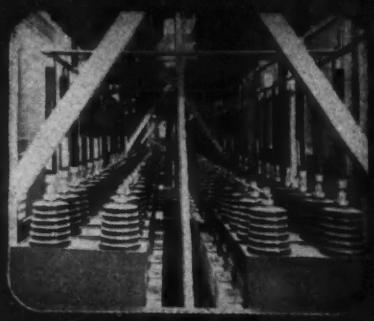
Name_____ Title_____

Company_____

Address_____

City_____ State_____

1939



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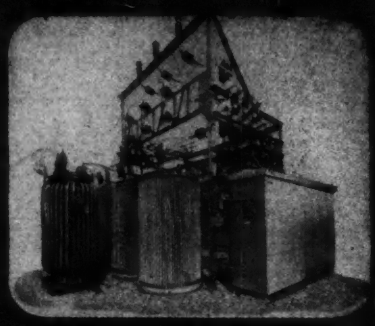

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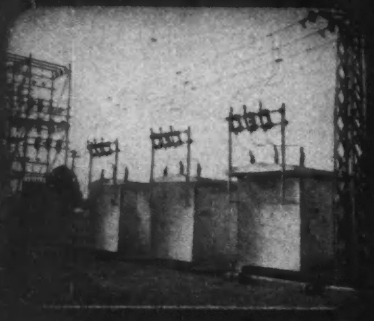

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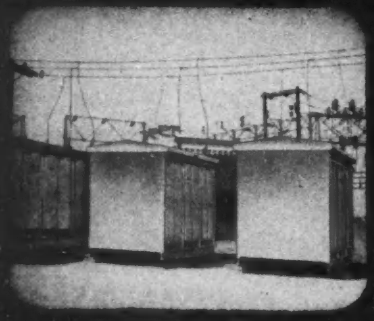

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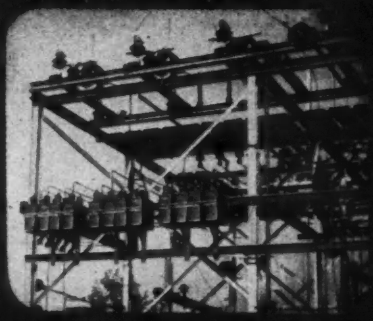

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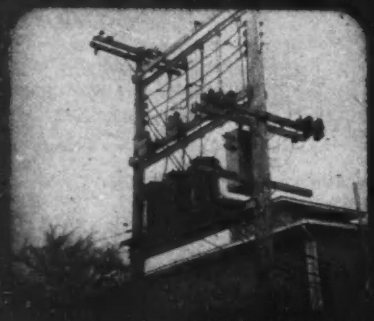

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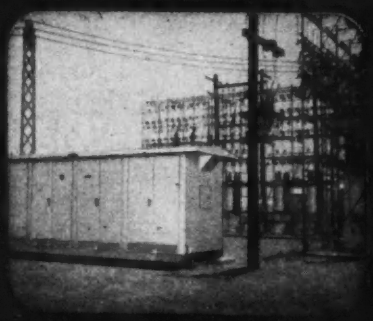

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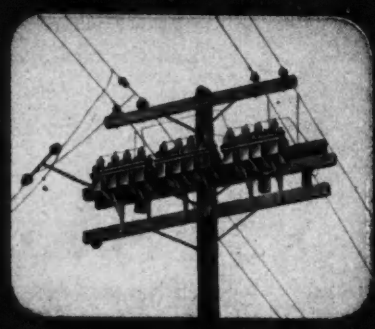

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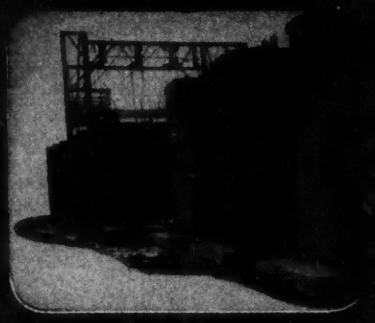

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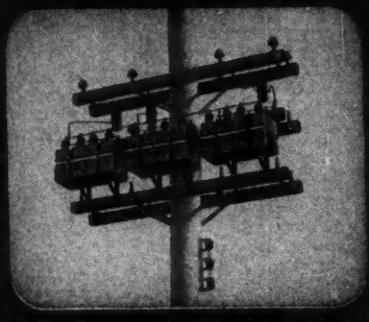

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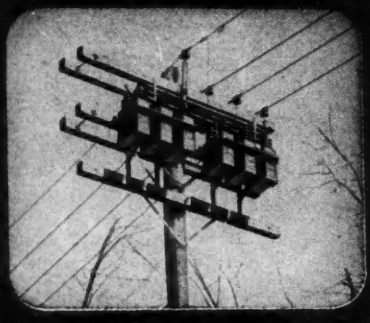

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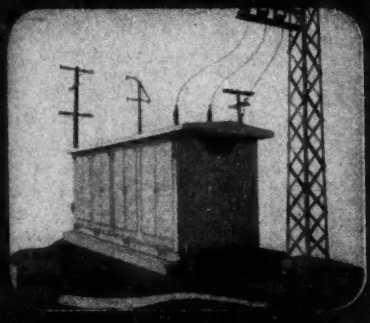


1946

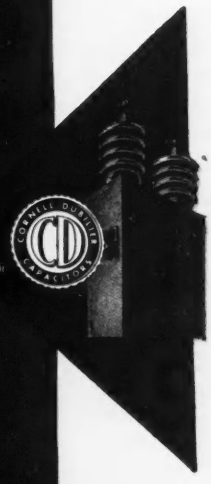
the Years write an impressive testimonial to Cornell-Dubilier Capacitors

You will find them in the stations and on the poles of the country's largest power producers: C-D capacitors that have been in continuous operation since 1938, 1939, 1940 with *little or no maintenance required!* Over 4,000 time-tested C-D installations confirm that this is truly the most *consistently dependable* capacitor for power-factor improvement.

C-D gives you these extra safety factors

- C-D capacitors are designed to withstand transient over-voltages as well as steady state voltages. Low dielectric unit stress provides this extra margin of safety.
- Heavy major insulation in the form of laminated liners with reinforced corners, insures highest impulse withstand levels.
- Only C-D capacitors (from 230 to 13,800 volts), are subjected to a full rated voltage energization test.
- Wide margin between paper and foil provides higher insulation level.
- Use of C-D's Dykanol results in lower unit weight per KVAR; high stability; long life.
- Heavy-Duty wet process porcelain bushings for longer creepage path, less breakage, higher impulse rating.

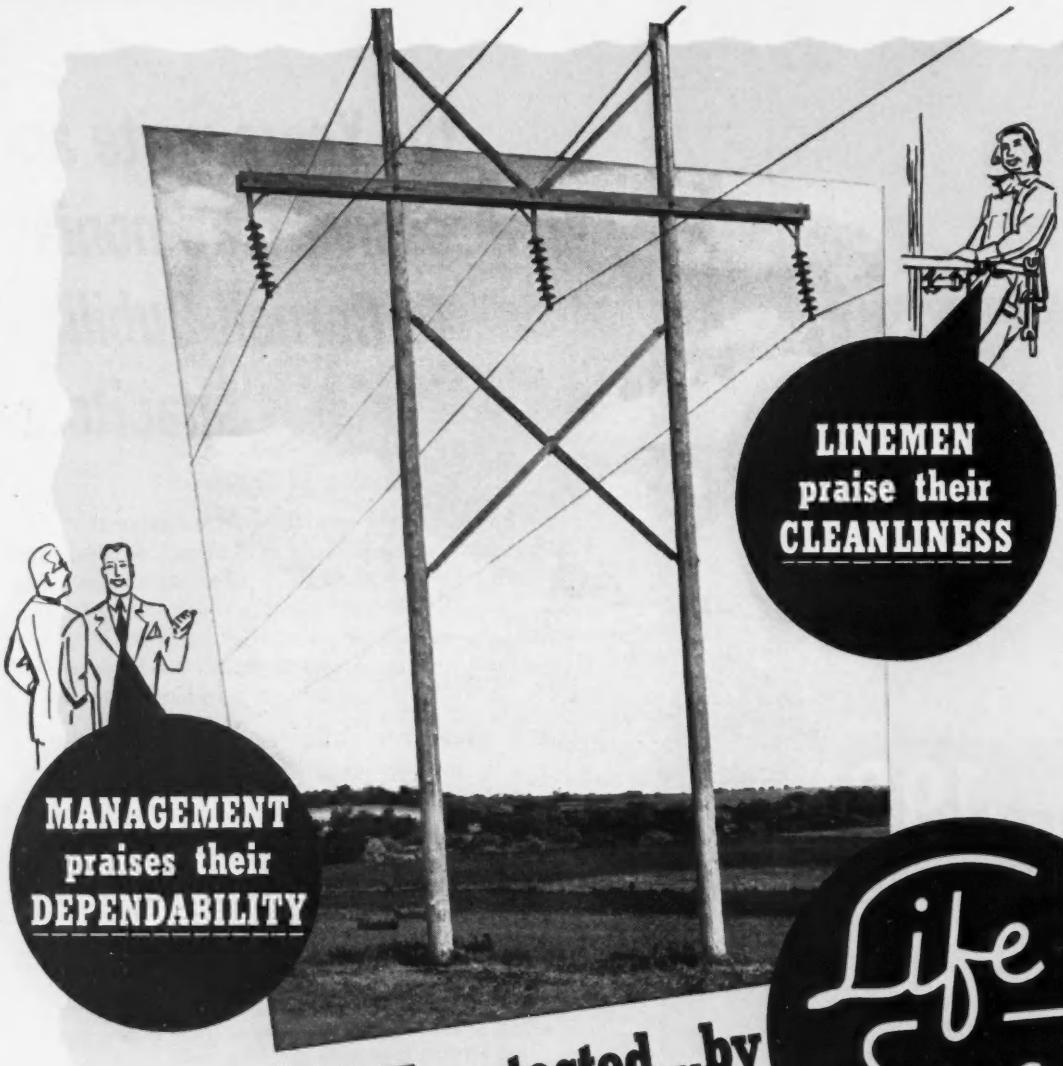
Planning an installation of industrial, station or pole-type capacitors for power-factor improvement? You can save maintenance dollars and insure trouble-free service by talking it over with a C-D engineer. Cornell-Dubilier Electric Corp., Dept. D-113, South Plainfield, N. J.



CONSISTENTLY DEPENDABLE

CORNELL DUBILIER CAPACITORS

PLANTS IN SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER, AND CAMBRIDGE, MASS.; PROVIDENCE, R. I.; INDIANAPOLIS, IND.; FUQUAY SPRINGS, N. C.; AND SUBSIDIARY, THE RADIART CORP., CLEVELAND, OHIO



LINEMEN
praise their
CLEANLINESS

MANAGEMENT
praises their
DEPENDABILITY

...They're BOTH protected...by Life Span

LIFE-SPAN

WESTERN RED CEDAR POLES are completely protected against termites and decay. Once protected they are sealed for life. Once installed they are set for many added years of dependable service. Maintenance costs go down, company profits go up! Here truly is unmatched dependability that is continually praised by management everywhere.

The lineman is protected too! He likes to work on LIFE-SPAN Poles because they are clean, easy to handle and safe to work on.

SOLD ONLY BY THE FOLLOWING:

Page & Hill, Inc.
Minneapolis, Minn.
50 Church St.,
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B. J. Carney & Co
Spokane—Minneapolis

Schaefer-Hitchcock Co.
Sandpoint, Idaho
(Suppliers for Joslyn Mfg. & Supply Co.)

Naugle Pole & Tie Corp
Chicago, Illinois

CONSOLIDATED TREATING CO.
MINNEAPOLIS, MINNESOTA

These huge natural gas engines, about 40 to a room, drive the generators, furnishing all the electricity used by Alcoa to produce 170,000,000 pounds of aluminum in this plant yearly.

800 BOXCARS OF AIR

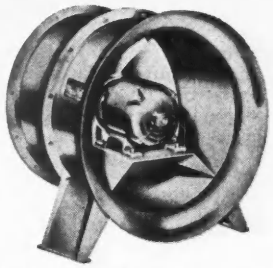
KEEP GENERATORS AT PEAK EFFICIENCY

Down at Point Comfort, Texas, a new kind of power plant was built a few years ago. 120 engines, running on natural gas, drive huge electric generators. Their job: to supply the current to smelt defense-needed aluminum. One of the biggest problems, though, was to keep the equipment running cool and thus at top efficiency.

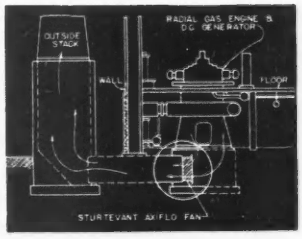
120 Westinghouse Axiflo® fans did the trick. Each draws 12,000 cubic feet of air through the generators every minute, picking up the excess heat. Then the air is piped through concrete ducts and out exhaust stacks which line both sides of the building.

Alcoa recently expanded this new power plant. When they did, they installed 74 new engines...and Westinghouse supplied 74 more Axiflows . . . All in all, the 194 fans will move over 2,300,000 cubic feet of cooling air through the generators *every minute*. That's enough air to fill a trainload of 800 boxcars!

One day—today or in the near future—you may have a problem that involves *putting air to work*. When you do, remember that Westinghouse has the most complete air conditioning, air cleaning and air handling line in the industry. See the new Catalog 600. It contains 60 fact-filled pages on products, uses, and helpful data. To get your free copy, just call your local Westinghouse-Sturtevant office. Or, write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.



Axiflo Fans keep them cool. They're compact, efficient, and trouble-free. That's important for hard-to-get-at jobs.

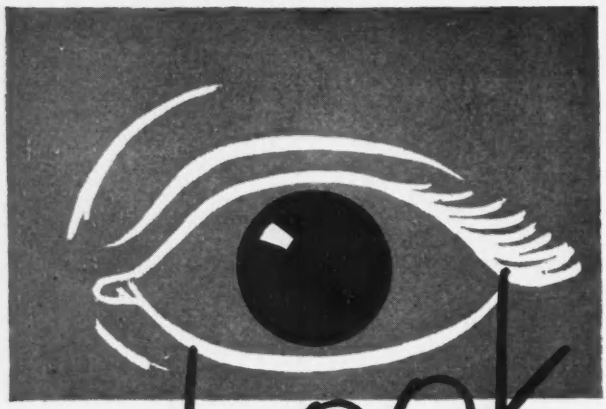


Cooling-air drawn through the engine generators picks up the intense heat, then safely exhausts it through individual stacks.

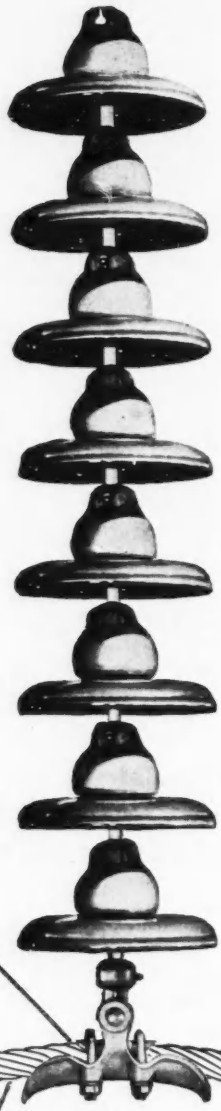
YOU CAN BE SURE...IF IT'S Westinghouse

J80281

AIR HANDLING



PREFORMED ARMOR RODS



• Maintain indefinitely their initial uniform, tight-fitting contact over the entire length of armor . . . assure uniform radial pressure throughout.

• Substantially reduce conductor stress at support points to minimize vibration fatigue.

• Do away with nuts, bolts and clamps, thereby eliminating any possibility of initial damage to conductor or subsequent loosening.

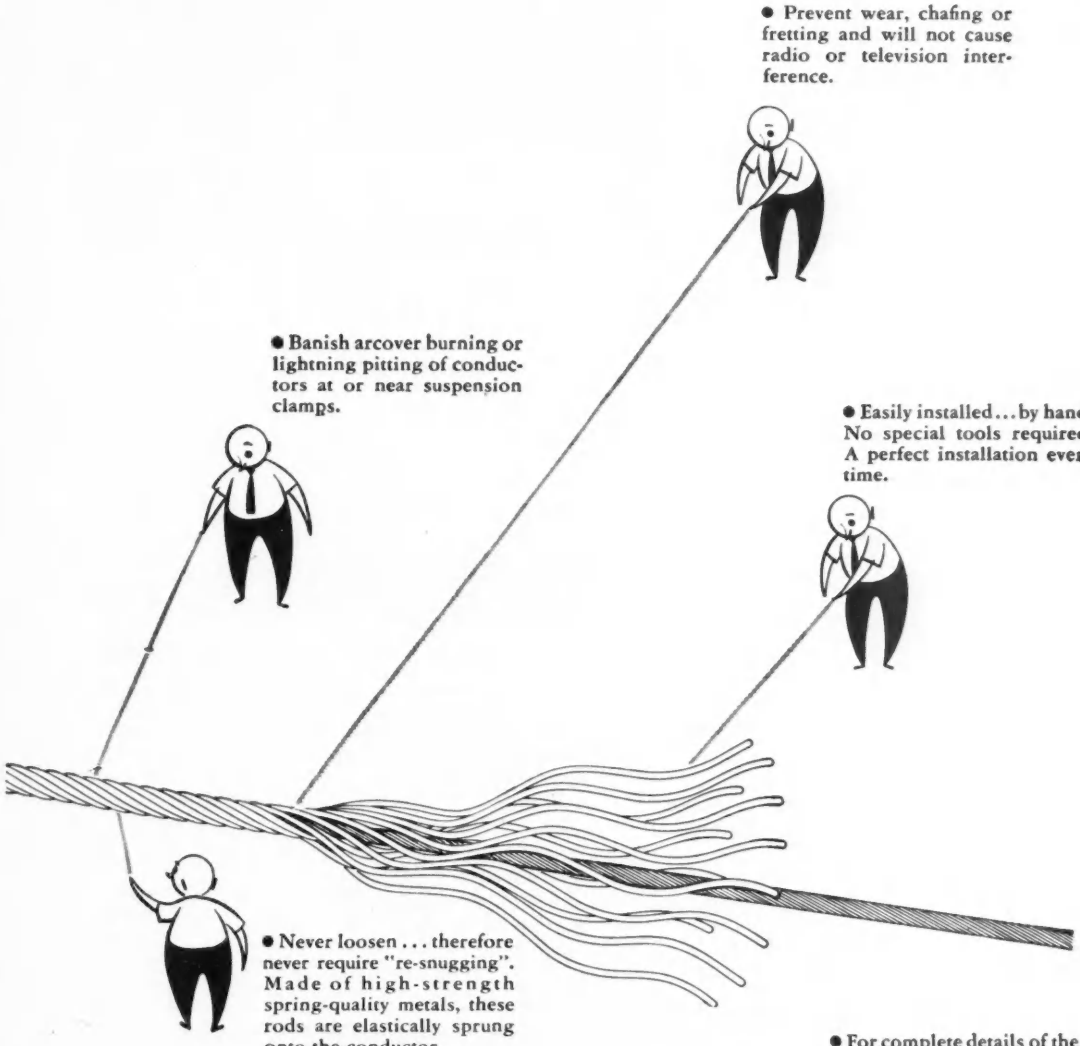
• Reduce operating temperature by providing a larger current path through the support.

**Preformed Armor Rods are manufactured under Patent No's 2,275,019 and 2,587,521 . . . other patents pending.*

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

TELEPHONE: CLEVELAND EXpress 1-3571



● Prevent wear, chafing or fretting and will not cause radio or television interference.

● Banish arcover burning or lightning pitting of conductors at or near suspension clamps.

● Easily installed... by hand. No special tools required. A perfect installation every time.

● Never loosen ... therefore never require "re-snugging". Made of high-strength spring-quality metals, these rods are elastically sprung onto the conductor.

● For complete details of the exclusive advantages of Preformed Armor Rods, write or telephone Cleveland: EXpress 1-3571.

SALES REPRESENTATIVES

C. B. Anderson Co., *Tulsa* ● **Bergstrom-Verbarg Co.,** *Minneapolis* ● **Vincent J. Brown Co.,** *Buffalo* ● **Burns Electric Co.,** *Pittsburgh* ● **Earl S. Condon Co.,** *Los Angeles* ● **Cory and Crum,** *Indianapolis* ● **The Electrical Distributors Co.,** *Philadelphia* ● **Engineer Sales Co.,** *St. Petersburg* **JSG Electric Co.,** *Chicago* ● **E. L. Flowers,** *Boston* ● **George R. Horne & Co.,** *Dearborn* ● **Johnson Sales Co.,** *Bay City* ● **H. L. Macon & Co.,** *Atlanta,* **Peterson Co.,** *Denver* ● **Elgin B. Robertson, Inc.,** *Dallas* ● **Elgin B. Robertson Co.,** *Houston* ● **K. M. Ryals Co.,** *San Francisco* ● **Shaffer and Nelson,** *Portland, Seattle, Spokane* ● **M. H. Snyder & Sons,** *New York* ● **Curtis H. Stout,** *Little Rock, Memphis, New Orleans* ● **L. G. Wendegatz,** *Kansas City*

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

Tapping rubber from one of the millions of trees on U. S. Rubber's giant plantations in Malaya.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables · Street Lighting · Royal Cords · Network Cables · Utility Control · Pole & Bracket Cable · Service Entrance · Weatherproof · Zip Cord Pole Fixture Cable · Sup. Control

RAILROADS: Power Cables · Communications · Railway Signal · Royal Cords · Welding Cable · Railway Utility · Sup. Control · Weatherproof

HEAVY INDUSTRY: Power Cable · Royal Cords · Welding Cables · Control Cables · Machine Tool Wire · Building Wire · Switchboard Wire · Thermostat Cable · Bus Drop Cable

OZONE
Absolute Tops in MOISTURE Resistance
HEAT

U. S. RUBBER'S BUTYL-INSULATED POWER CABLES

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 80 C. The insulation will not crack after four hours in air containing 0.015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalies and corrosive chemicals. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Butyl Insulation			Neoprene Jacket	
	Unaged	After 168 Hrs. in O.B. at 80 C.	After 7 days in Air Oven at 250 F.	Unaged	After 96 Hrs. in O.B. at 70 C.
Tensile, lbs. per sq. in.	600	500	400	1800	1600
Elongation, per cent	400	350	350	300	250

MOISTURE RESISTANCE (MAXIMUM VALUES)

a. Dielectric constant and power factor of insulation after immersion in water at 50 C.

Dielectric constant, one day	4.0
Per cent gain, 1 to 14 days	2.0
Per cent gain, 7 to 14 days	1.0
Power factor, one day, per cent	2.0

b. Mgs. per sq. in., 7 days at 70 C. 15.0

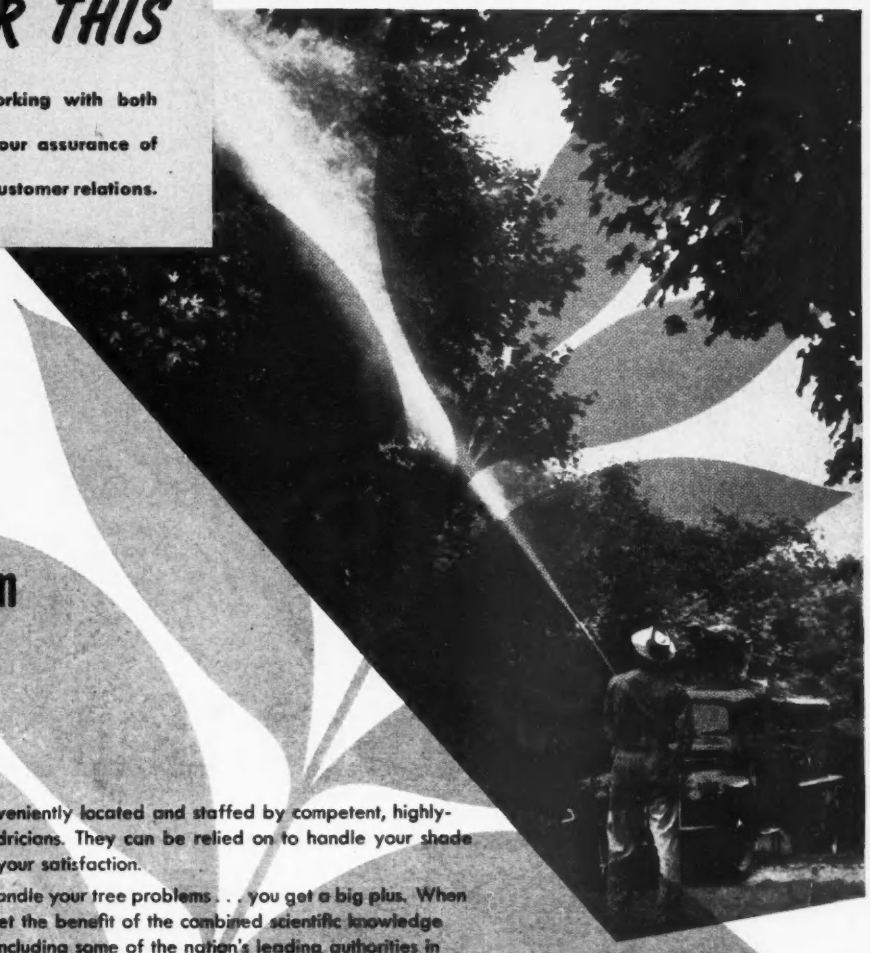
U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

REMEMBER THIS

Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.



Bartlett branches stem from research

Bartlett branch offices are conveniently located and staffed by competent, highly-skilled diagnosticians and dendricians. They can be relied on to handle your shade tree problems skillfully and to your satisfaction.

But in employing Bartlett to handle your tree problems . . . you get a big plus. When you consult with Bartlett, you get the benefit of the combined scientific knowledge and long practice of a group including some of the nation's leading authorities in tree health and protection. Scientists are continually searching for new and better ways to protect the shade trees of America at the Bartlett Tree Research Laboratories in Stamford, Connecticut. So, any decision your Bartlett Representative makes is not based on his own individual judgment . . . it's based on years of experience of the whole Bartlett organization.

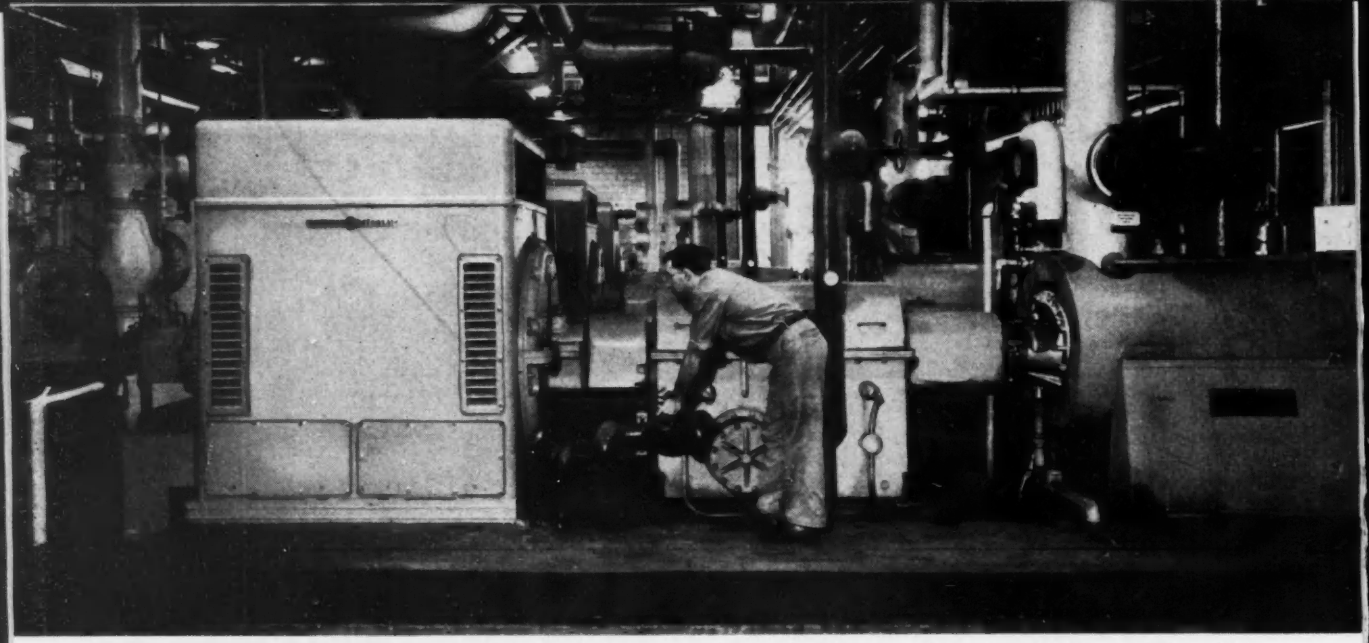
That's why a great many Bartlett clients engage Bartlett services on a yearly basis to care for their trees and guard them against insects and disease. They appreciate the continual improvements and advancements the Bartlett Way provides.

No wonder those who are critical of results are turning more and more to the Bartlett Way. You, too, can benefit by Bartlett services. Call the nearest Bartlett office for a study of your tree condition.

The Bartlett Way

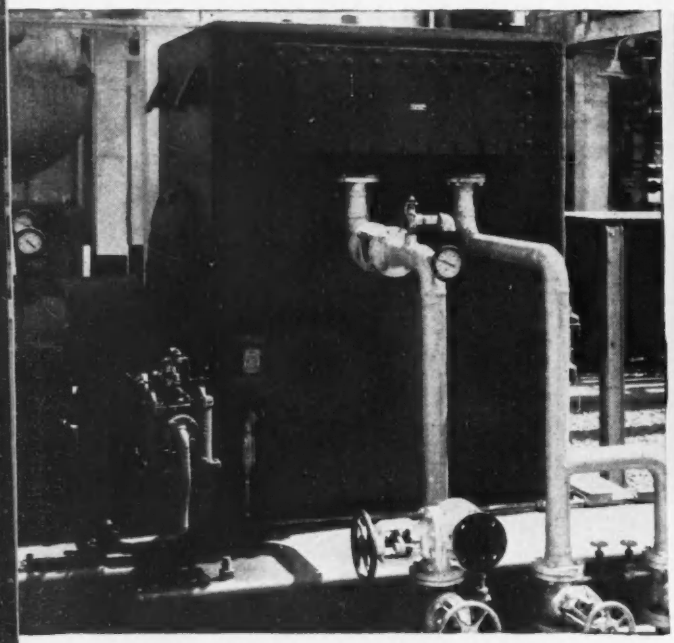
BARTLETT TREE EXPERTS, *Stamford, Conn.*

Branch Offices: Rutland, Windsor, Vt.; Concord, Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Osterville, Pittsfield, Prides Crossing, Mass.; East Providence, R. I.; Danbury, Hartford, New Haven, Stamford, Westport, Conn.; Islip, Kingston, Monroe, Middletown, New York, Southampton, Syracuse, Westbury, White Plains, Yorktown Heights, N. Y.; Bernardsville, Orange, N. J.; Chambersburg, Paoli, Philadelphia (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Zanesville, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Charleston, Huntington, W. Va.; Kingsport, Tenn.

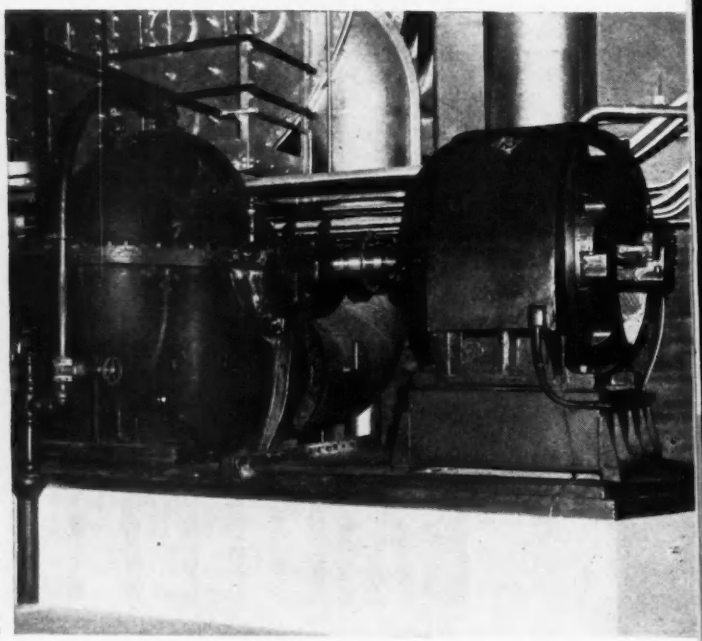


G-E BOILER FEED PUMP MOTORS in a typical application at Detroit Edison's Connor's Creek Plant. Designed especially for boiler feed pump service, 1000 hp ratings and larger, this motor permits closer spacing because of unique ventilating system and cubical shape . . . conserves floor space. You get improved performance from streamlined rotor design which also gives quieter operation. Dual lubrication system combines the advantages of force-flood lubrication and self-lubricated oil rings. Modern appearance blends with power station styling. Write for Bulletin GEA-5813.

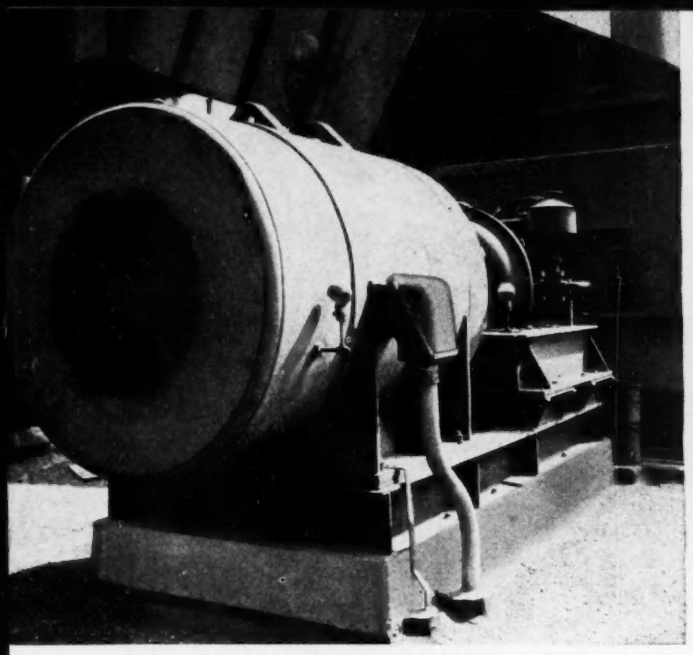
Proved Motor Dependability



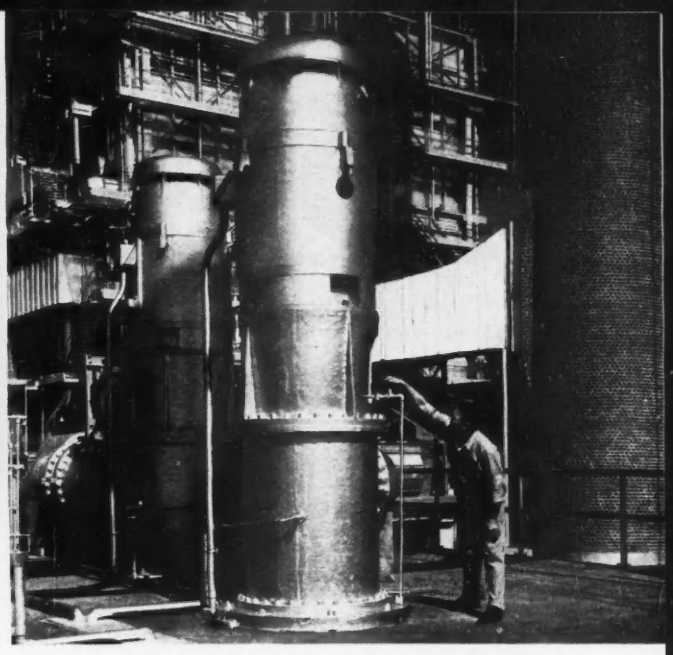
G-E TOTALLY ENCLOSED AIR-WATER COOLED MOTOR is an economical choice for 250 hp and larger. Simple to install, it needs no ducts, filters or blowers. Total enclosure means less maintenance by keeping out dust and other foreign particles. Shown here driving blower in a Kansas plant.



LARGE G-E OPEN DRIPPROOF MOTORS, four or more poles, such as this one coupled to circulating water pump in Cliffside Steam Station of Duke Power Company, are designed for indoor applications only. They are widely used on hot well pumps, forced- and induced-draft fans, and coal pulverizers.

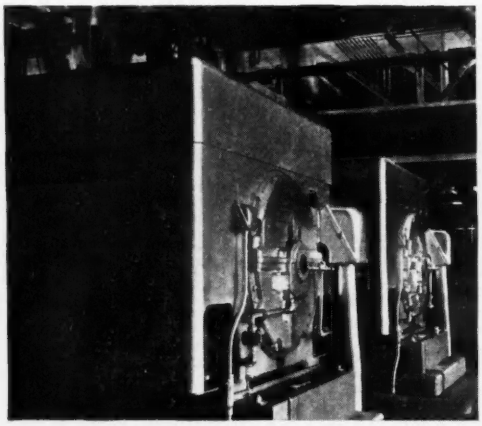


THIS G-E TOTALLY ENCLOSED FAN-COOLED MOTOR drives an induced-draft fan in the Edwardsport Steam-electric Power Station of Public Service Company of Indiana. Total enclosure assures the ultimate in motor protection required for operation in severe atmospheric conditions.



G-E VERTICAL TOTALLY ENCLOSED FAN-COOLED MOTORS, with Tri-Clad* construction, such as these driving pumps at New Orleans Public Service Inc., A. B. Paterson Steam-electric Generating Station, are used for dependable, low-maintenance service in severe ambient conditions.

for Power Station Service



TWO G-E WEATHER PROTECTED MOTORS, grade mounted, driving boiler feed pumps at Florida Power & Light Company's Cutler Plant. Available also in vertical and base ventilated design, this low-cost motor is designed especially for outdoor service where the extra protection of totally enclosed fan-cooled design is not economically justified. Bulletin GEA-5810.

*Reg. Trade-mark of General Electric Co.

G.E.'s complete line of power station auxiliary motors—field proved—assures you of getting the right motor for every operating requirement and station design.

Power stations across the country have installed dependable G-E motors for every auxiliary use. Because of the extensive field study that General Electric has devoted to power station requirements and the engineering experience gained through building all types of power station equipment for over 70 years, you are always assured of getting the right motor for economical and dependable service.

Whatever your needs in power station motors, General Electric can furnish the right type and size from a complete line . . . a wide variety of designs, enclosures, and application variations. You get exactly the motor needed to meet conditions of your operating practice, economics or location.

For more information on G.E.'s complete line of power station auxiliary motors contact your nearest G-E Apparatus Sales Office. *General Electric Co., Schenectady 5, N. Y.* 753-6

GENERAL ELECTRIC

Compare

CHASE® COPPER BUS CONDUCTORS WITH ANY OTHERS . . . . . for capacity
. . . for copper savings
. . . for efficiency

Chase ventilated square tube buses can cut your copper requirements up to 36% as compared with flat rectangular bars.

The current ratings of some of the Chase ventilated square tube buses are given in the table to the right. Bear in mind that the square tube bus is a one-piece bus and is not a composite bus consisting of two or more parts.

Send for Chase Copper Bus Conductor booklet giving information on Chase ventilated square tube, flat rectangular and round copper tube buses.

CURRENT CARRYING CAPACITY OF ONE-PIECE BUS

	Square Inches	Current Rating at 40° C. Rise
7 x 7 x 3/8 Ventilated	9.06	7760
8 x 8 x 5/16 Ventilated	8.80	8400
9 x 9 x 1/4 Ventilated	7.93	8560

Chase BRASS & COPPER

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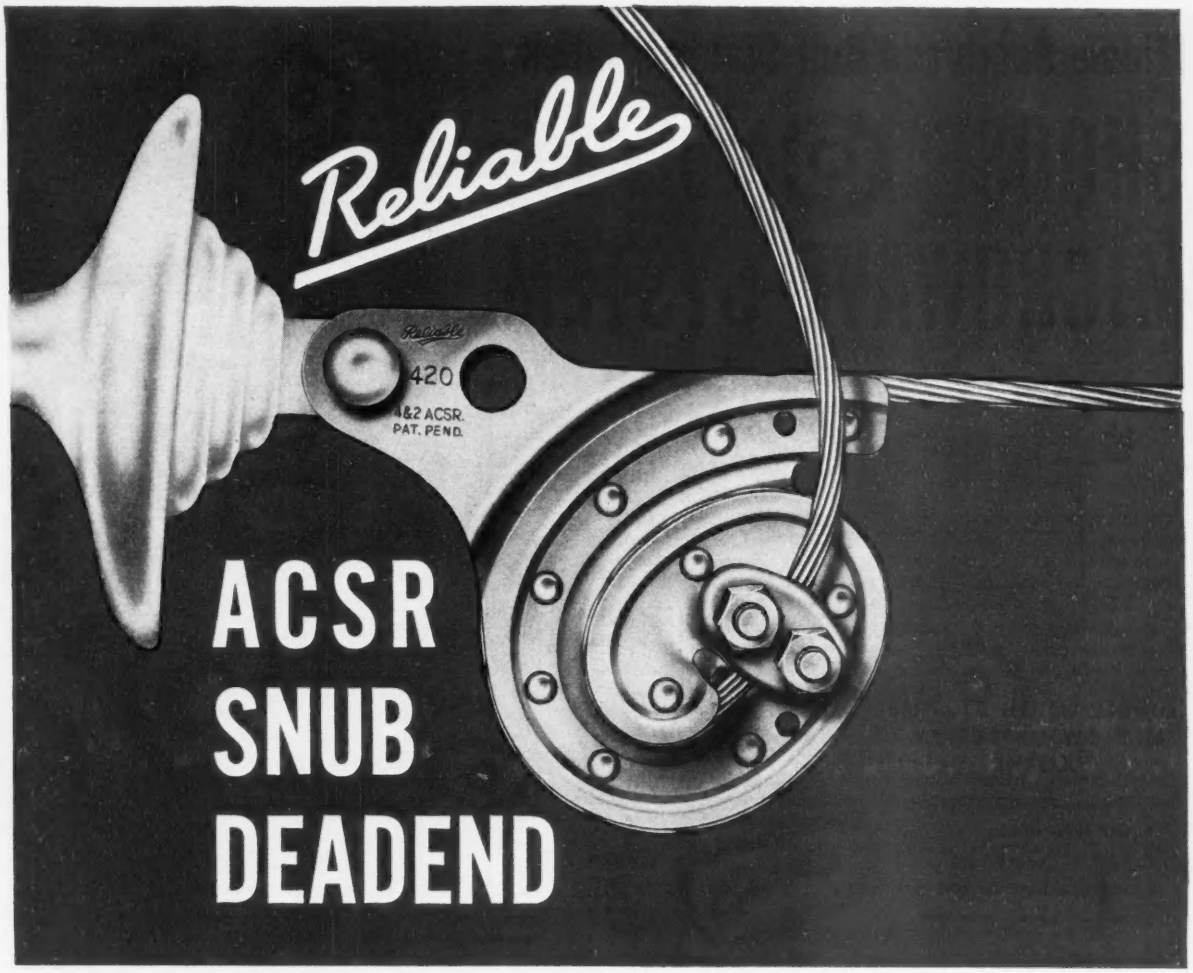
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester †	(† sales
Cincinnati	Indianapolis	New Orleans	St. Louis	office only)



makes CORE and STRAND Share the Load

Once the two-bolt clamp is tightened on the Reliable No. 420 Snub Deadend, both the steel core and the aluminum strand carry their full share of the load. There is no slippage that throws all the load on the aluminum strand. The two-bolt clamp is simple to tighten and subjects the ACSR to a minimum of vibration fatigue. This deadend is approved for use without armor tape. No. 420 ACSR Snub Deadend has the added advantage of being extremely light in weight. Many thousands of these deadends are giving unobtrusive yet unfailing service.

Reliable ELECTRIC COMPANY

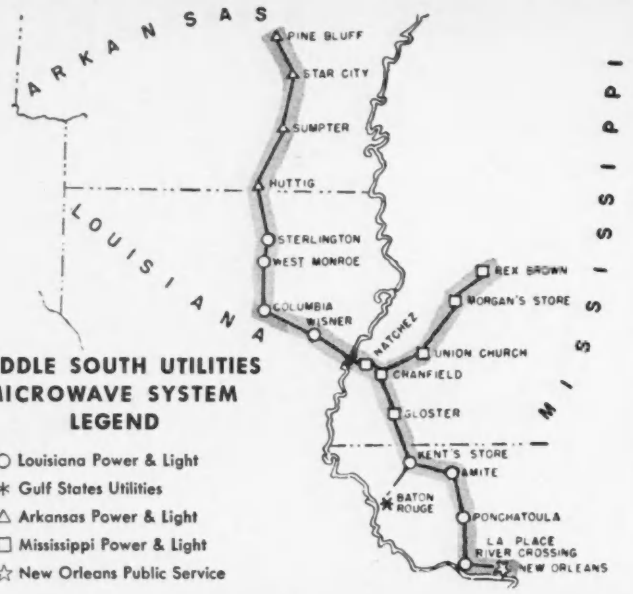
3145 CARROLL AVENUE
CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES

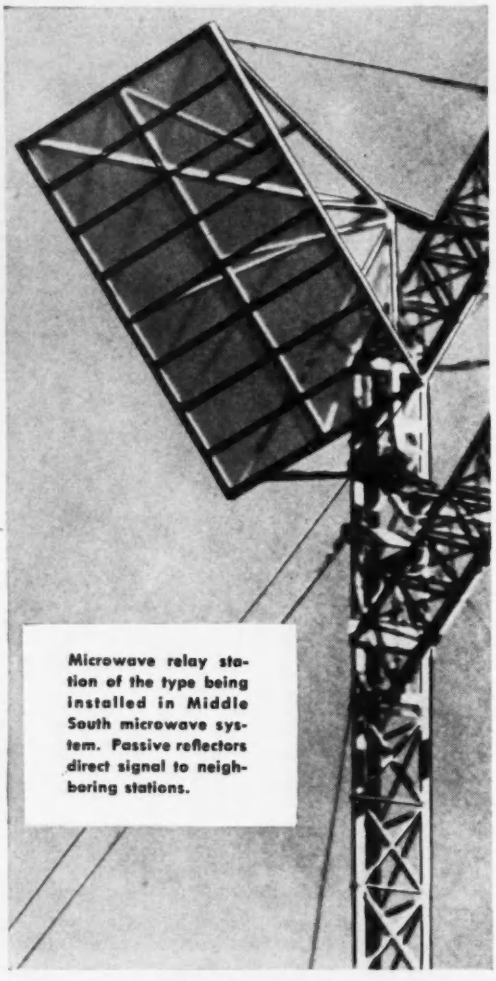
Middle South and Gulf States Utilities

CHOOSE Motorola for MICROWAVE SYSTEM



MIDDLE SOUTH UTILITIES MICROWAVE SYSTEM LEGEND

- ○ Louisiana Power & Light
- ✳ Gulf States Utilities
- △ Arkansas Power & Light
- □ Mississippi Power & Light
- ☆ New Orleans Public Service



Microwave relay station of the type being installed in Middle South microwave system. Passive reflectors direct signal to neighboring stations.

Vast Motorola Network will assure continuity of service . . . adequate power . . . for Middle South consumers.

Motorola microwave will soon blanket Louisiana, Mississippi and Arkansas with one of the largest networks of its type in the world. 11,000 channel-miles, at the disposal of five Middle South Utilities, will speed supervision and control of power throughout the area.

Motorola Microwave enables your vital communication to keep pace with ever-increasing power systems. Job-proven Motorola microwave is first choice of industry across the nation. Discover now how it can help *you* cut costs and improve service.

Write today to Dept. 2286-EW

Multi-Channel Utility—private line, party line, teletype, audio frequency carrier for telemetering, supervisory control and mobile radio.

Motorola Systems Are In and Working for These Companies

Below is a partial list of systems installed and operating, and those under construction (*).

Pacific Power and Light Co., Portland, Ore.
Brazos River Electric Transmission Cooperative, Waco, Tex.
Illinois Power Co., Decatur, Ill.
Central Illinois Public Service Co., Springfield, Ill.
Pan American Pipeline Co., Houston, Tex.
Shell Pipeline Co., Houston, Texas
Panhandle Eastern Pipeline Co., Kansas City, Kan.
Southern Counties Gas Co., Los Angeles, Calif.
La Fourche Telephone Co., Golden Meadow, La.
Mid-Valley Pipeline Co., Longview, Tex.
Greenwood Telephone Co., Greenwood, S. C.
*Bonneville Power Administration, Chehalis, Wash.
*Sinclair Pipeline Co., Independence, Kan.
Freeport Sulfur Co., New Orleans, La.
*West Coast Telephone Co., Everett, Wash.
*Dayton Power & Light Co., Dayton, O.
Southern California Edison Co., Los Angeles, Calif.
*Middle South Utilities, Pine Bluff, Ark.

—with many additional systems under construction

Job-Proven Microwave

Motorola®

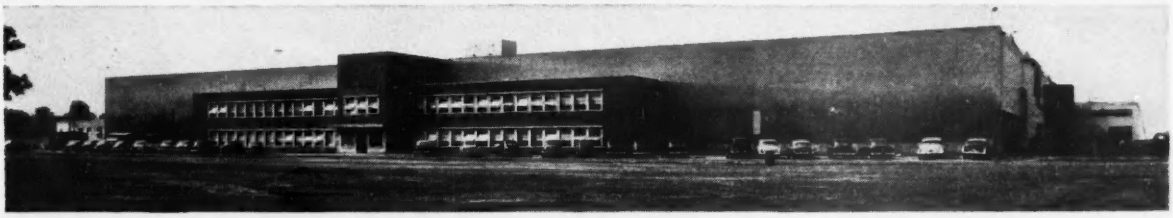
Communications & Electronics, Inc.

A SUBSIDIARY OF MOTOROLA, INC.

900 N. Kilbourn Ave., Chicago 51, Illinois • Rogers Majestic Electronics Ltd., Toronto, Canada

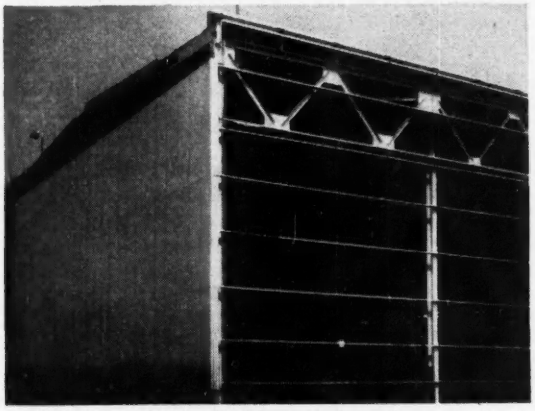
WHEN ANSWERING THIS ADVERTISEMENT, PLEASE MENTION "ITEM 5365"

SHEETS OF STAINLESS STEEL enclose the 34 to 36 foot walls of the new plant of United States Steel Homes, Inc. near Harrisburg, Pa. Stainless sheets were fabricated and erected by American Bridge Division of United States Steel Corporation, and the general contractor was Ritter Brothers, Harrisburg.



Walls of Stainless Steel will keep maintenance costs low in this new plant of United States Steel Homes, Inc.

HERE WORKMEN are bolting the 30" corrugated Stainless Steel sheets to the structural steel frame. Erection is fast and simple; it requires a minimum crew and can be carried out in any type of weather.



THIS VIEW shows Stainless Steel sheets attached to the structural steel framework of the plant. All flashing and trim is Stainless Steel, too.

HERE is one of the largest industrial structures to emerge from the growing trend toward use of Stainless Steel for exterior walls. It's the new plant of United States Steel Homes, Inc.—formerly Gunnison Homes, Inc.—located near Harrisburg, Pa.

The plant is an "L"-shaped structure with approximately 310,000 square feet of floor space. The entire exterior is covered with sheets of 26-gage corrugated Stainless Steel, used in 30" widths. Approximately 55 tons of Stainless Steel were used.

Reduction of maintenance costs was the primary reason for selection of Stainless Steel sheets. The walls will not require painting and a long, trouble-free life is anticipated. And, in addition, Stainless Steel gives the plant an attractive over-all appearance.

Stainless Steel sheets and panels offer so many advantages, both in construction and through the life of the building, that their cost-per-year is lower than almost any other material. They are considered outstanding developments in the field of industrial construction today.

Panels are available uninsulated or with filler-type insulation between the exterior Stainless sheet and the interior sheet of carbon steel. This makes them suitable for the widest range of building types—plants, warehouses, power plants, office buildings and many others.

If you would like more information on Stainless Steel sheet and panel construction, mail the coupon below.

United States Steel Corporation
525 William Penn Place, Room 2819-J
Pittsburgh 30, Pa.

☐ Please send me your new booklet on U·S·S 17 Stainless Steel for industrial buildings.

☐ Please arrange to have fabricators of Stainless Steel wall panels send me literature on their particular type of construction.

Name..... Title.....

Address.....

City..... State.....

United States Steel produces only the Stainless Steel sheet and strip from which panels of this type are made; the panels themselves are fabricated by a number of our customers.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

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UNITED STATES STEEL

EXCEEDS CLASS III SPECIFICATIONS

Wet or dry, pick your flashover test, NEW Kimble *Tempered* Glass insulators show flashover resistance exceeding A.I.E.E. requirements. In puncture tests, too, *Tempered* Glass insulators are outstanding. It has proved impossible to puncture them in air, even under the most severe maximum voltage impulses applied. Four years of field testing on more than 500 miles of line have produced no puncture failure. Even lightning surges have failed to damage them.

If it's on the pin, it's in service

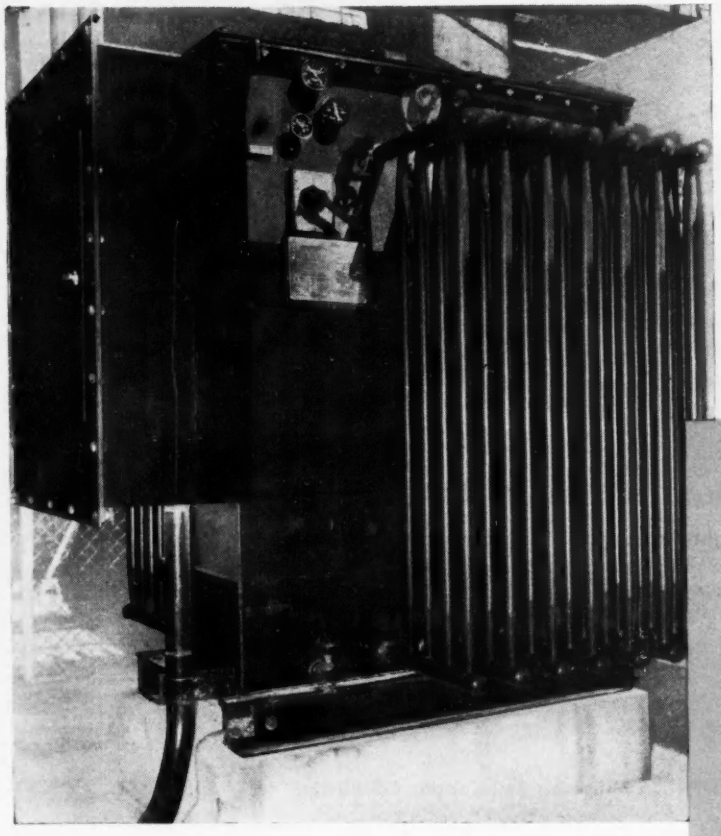
In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. It's a Kimble production method that gives Kimble insulators a hard-compression surface layer that makes them strong enough to meet the severe test required. This great strength saves installation time because it's never necessary to loosen for line up with the conductor—they can always take another quarter-turn.

Why not see how *tempered* glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Glass Company, Dpt. EW-11, Box 1035, Toledo 1, Ohio.

KIMBLE GLASS COMPANY

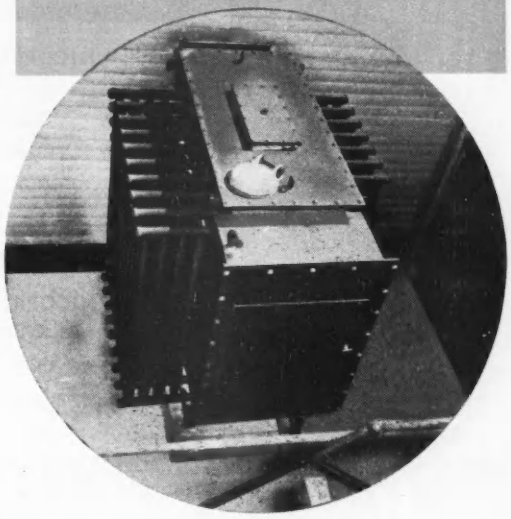
Toledo 1, Ohio—*Subsidiary of Owens-Illinois Glass Company*



at Maywood Chemical Works

Uptegraff POWER TRANSFORMER helps speed expansion program

When additional electric power was needed to serve expanded facilities of the Maywood Chemical Works, Uptegraff was able to furnish the required type of transformer and meet the delivery deadline. The photographs show two views of this transformer, a 750 KVA Power Unit, 4160 Grd.Y/2400 —480 Delta volts, 3 phase, 60 cycle. It includes provisions for adding thermometer controls to actuate cooling fans on radiators if needed for future load increase.



Bird's Eye View
shows the clean, open construction of radiators, with large cooling area and ample space for cleaning and painting.

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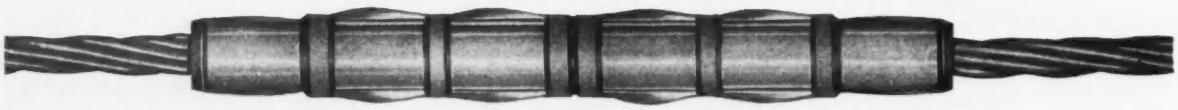
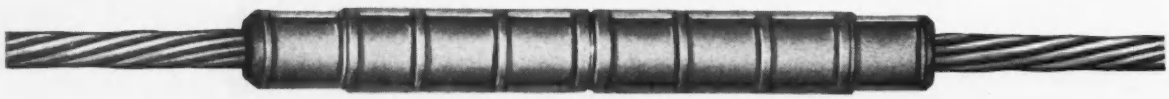
SPLICING SLEEVES

FOR LARGE CONDUCTORS AND HIGH-STRENGTH STRANDS

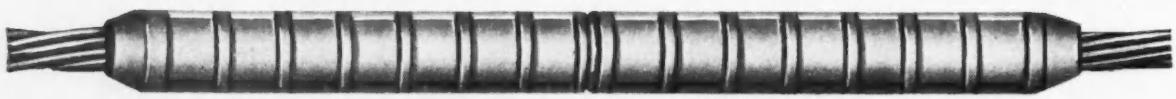
**Light in weight—Holds full strength of conductor—
High in conductivity**



Completed NICOPRESS Splice on 3/0 Copper Conductor



**Completed NICOPRESS Splice on ⅜" Extra High Strength
Copperweld Strand**



**Completed NICOPRESS Splice on ⅜" Extra High Strength
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—year after year

Air Preheater Corporation Field Engineers aim to visit every Ljungstrom Air Preheater in this country at least once a year. Their main objective is to increase availability and assure you a maximum return on your investment. They are always available for consultation.

This is just another reason why the Ljungstrom Air Preheater is *the most economical heating surface on the modern boiler.*

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JOPPA • MERAMEC
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OAK CREEK
SUWANNEE RIVER
MULLERGREN
MILLIKEN
BARRY
SANDOW
URQUHART
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NEW EASTLAKE POWER PLANT

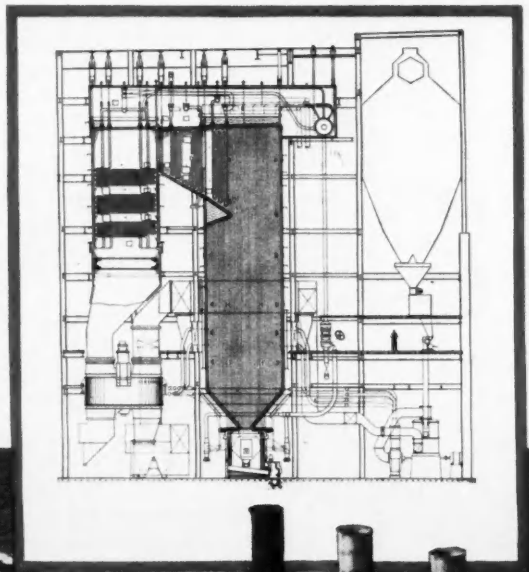
goes into service.

Located on the south shore of Lake Erie where it is joined by the Chagrin River stands the new Eastlake steam generating plant of The Cleveland Electric Illuminating Co. With a planned ultimate operating capability of more than 1,000,000 kilowatts, its ultimate cost upon completion will be well in excess of $125,000,000.

The first electric power from Eastlake went "on the line" in mid-September to serve the growing demand of industrial, commercial, and residential customers in Cleveland-Northeast Ohio. The initial unit is a 125,000-kilowatt turbine-generator. By the Spring of 1954 two additional 125,000-kilowatt turbine-generators will be "on the line."

Fourth power plant in the Illuminating Company's interconnected system, Eastlake is in the modern power plant tradition — bigness plus efficiency. By year-end 1955, the new ranch-style structure will house three 125,000-kw units, and a fourth — much larger — unit of 208,000-kw capacity.

All the turbine-generators mentioned above are served by C-E Controlled-circulation Boilers. The first generator — now in service — and two duplicates, presently under construction, are each supplied by a C-E Unit as illustrated and briefly described on the opposite page. The fourth generator — of greater capacity — will be served by a C-E unit of similar design but of proportionately larger size. B-705



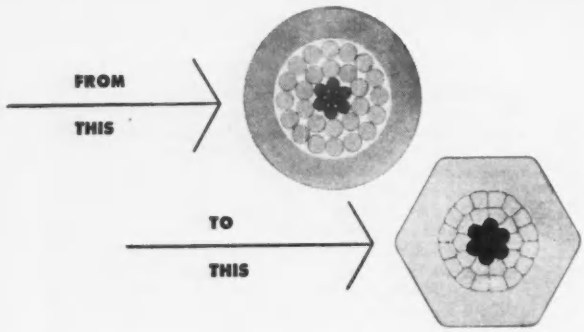
The C-E Unit shown at the left is now in service at the new Eastlake Power Plant. Two duplicate units are presently under construction. These units are of the controlled-circulation, radiant, reheat type, with a reheater section located between the primary and secondary superheater surfaces. An economizer section follows the rear superheater section and regenerative type air heaters follow the economizer surface. Pulverized coal firing is employed using bowl mills and tilting, tangential burners. Each unit serves a 125,000-kw turbine-generator operating at a throttle pressure of 1800 psi with a primary steam temperature of 1050 F, reheated to 1000 F.

COMBUSTION ENGINEERING, Inc.

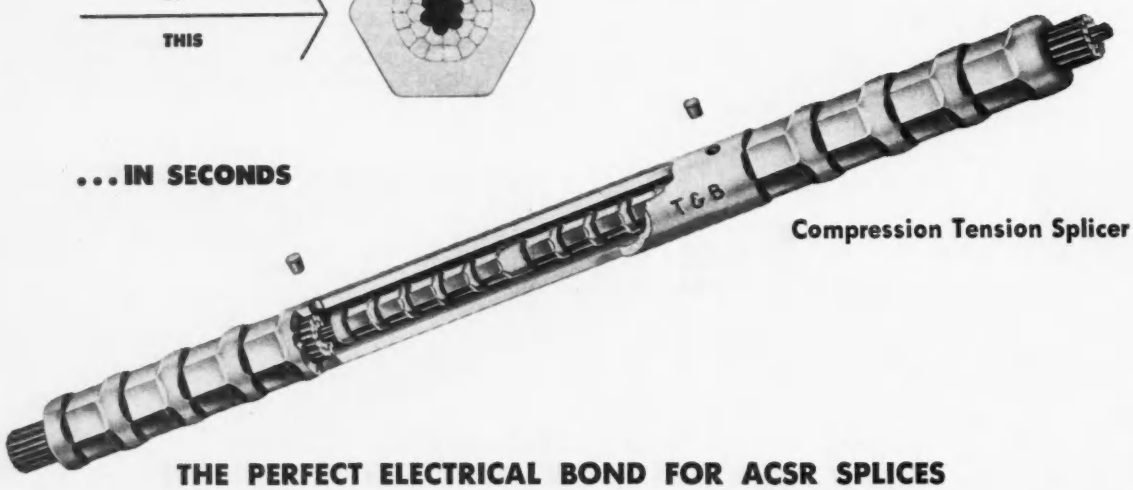
Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

T & B METHOD



...IN SECONDS



Compression Tension Splicer

THE PERFECT ELECTRICAL BOND FOR ACSR SPLICES

The T & B METHOD tension splicer for ACSR provides greater electrical conductivity than an equal length of cable. Fabricated from pure extruded aluminum tubing having electrical and thermal properties equal to the cable, the contact surfaces are serrated and factory coated with an oxide inhibitor. Positive, clean electrical and mechanical contact with the cable is assured.

The steel core sleeve is made from drawn seamless tubing, serrated and coated to provide tension in excess of the breaking strength of the steel core.

Both sleeves are easily installed with T & B METHOD light-weight, portable tools. Under high pressure, the hexagonally shaped dies compress the joint into a homogeneous mass, abrading aluminum oxide film from each cable strand.

The result: a streamlined, light-weight splice that satisfies all requirements for electrical and mechanical efficiency.

The standard practice of using an oxide inhibitor on all aluminum joints is recommended on T & B METHOD aluminum connections. No joint compound is required to obtain maximum electrical efficiency.

Investigate the complete line of T & B fittings for ACSR, aluminum cable and copper cable installation – they offer you important savings in time and installation costs. Write for your free copy of T & B Bulletin U-2.

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The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

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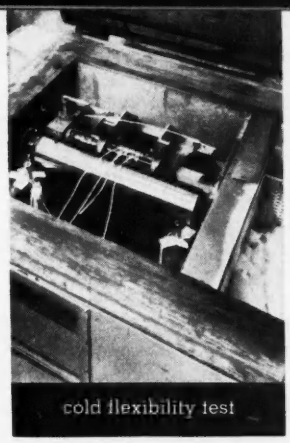
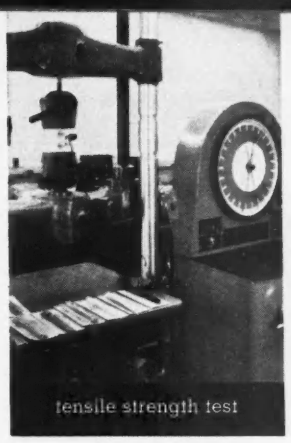
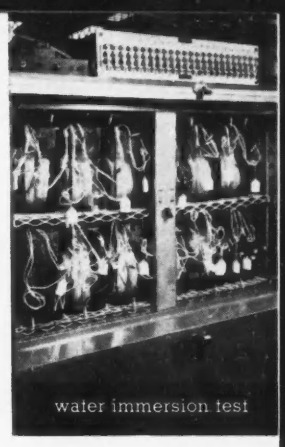


cold flexibility test



tensile strength test

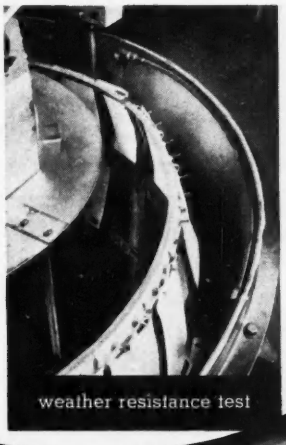


water immersion test

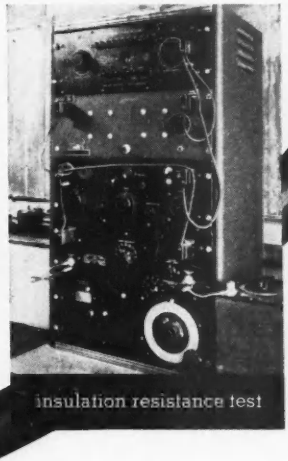
Tested for All-Round Service...

BAKELITE TRADE-MARK Polyethylene

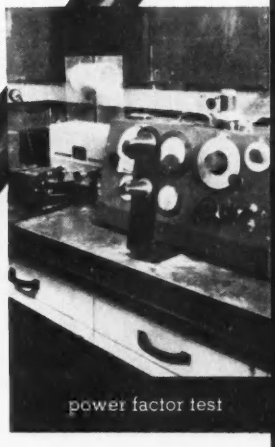
for Service Drop and Line Wire Covering



weather resistance test



insulation resistance test



power factor test

These laboratory tests made on BAKELITE *Polyethylene* demonstrate the service you can expect from service drop and line wire covering made of this outstanding dielectric material.

It endures weathering in a machine that crams years of sunlight and rain into hours. It retains its flexibility at −70 deg. C. As a covering for wire that carries 600 volts, it withstands immersion in water at 50 deg. C. for 24 weeks, without affecting insulation resistance. Separate tests for tensile strength, power factor, and insulation resistance reveal its outstanding performance qualities.

BAKELITE *Polyethylene* is extremely light in weight. Specific gravity is only 0.92 for natural and 0.94 for black compound. This means easier handling, fewer poles needed. Excellent physical and electrical properties make possible a thinner wire covering that is readily stripped and spliced. It won't festoon. It meets ASA specifications (second draft: July 20, 1952) for weather-resistant wire and cable.

Kabelitems #48 describes the properties of BAKELITE *Polyethylene* wire covering in detail. To get your free copy, write Dept. SC-63.

OUTSTANDING ELECTRICAL PROPERTIES (black compound) for signal systems and service drop, wet or dry—at 50 megacycles and 25 deg. C., power factor is only 0.004; dielectric constant, 2.5. These values hold through the range from 60 cycles to 5×10^7 cycles. Operating temperatures up to 90 deg. C. have little effect on electrical properties. Insulation resistance is too high to measure on conventional testing devices. BAKELITE *Polyethylene* excels in resistance to voltage breakdown, even after long-continued water immersion.

BAKELITE TRADE-MARK
Polyethylene
WIRE COVERING

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N.Y.
In Canada: Bakelite Company (Canada) Ltd. Belleville, Ont.

"Toughest operating but the first batch of

THIS IS A TYPICAL DRILL. It uses a 4-conductor No. 8 Amerclad cable.

Says Chief Electrician, Hudson Plant,
Universal Atlas Cement Company

● Year after year, at this quarry, the Amerclad is exposed to knife-sharp fragments of flying rock. During the summer, the rock often gets so hot that you can't even touch it. Other times, the cable lies out in the rain and snow— often at sub-zero temperatures.

At the Hudson, N. Y. quarry of Universal Atlas, Chief Electrician Frank Rodmond said, "This Amerclad runs the constant danger of being hit with flying rock fragments through secondary blasting. Yet the down-time cost of this operation is so high that we just can't stand cables that keep failing. We kept that last batch of Amerclad 12 years before we replaced it, yet it was still serviceable when we switched over to new Amerclad."

If you want service like this, specify Amerclad the next time you need cable that can really take it. Amerclad is available in a great many sizes and constructions, with or without shielding. There is a type to power anything from a river dredge or mine locomotive down to a rough and tumble electric hand drill. *Send the coupon,* and get more information.

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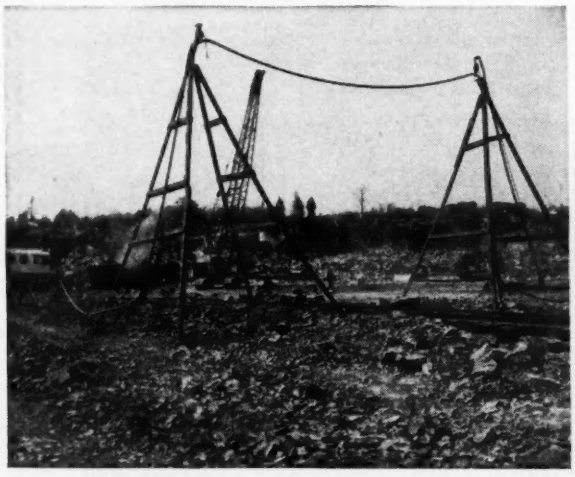
A STANDARD Cable for

- **paper & varnished cambric cable**
- **asbestos wire and cable**
- **aerial, underground & submarine cable**
- **shovel & dredge cable**

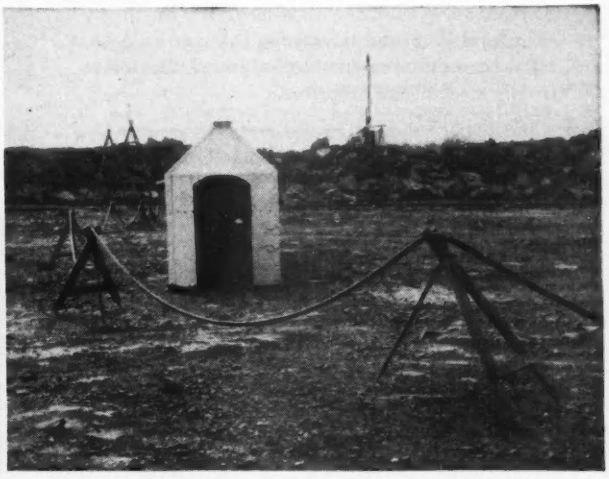
U·S·S AMERICAN ELECTRICAL

condition in our quarry—
Amerclad lasted 12 years"

NOTICE THE CABLE TRAY fastened to the shovel. This was developed by Universal Atlas for easier cable handling—it also prolongs life of the cable.



HERE A CABLE is raised on horses to clear the railroad track. It feeds the shovel visible in background.



TWO WORKMEN WATCH from blast shelter as charge is set off in distance. Low horses cushion cable from shock of falling rock in secondary blast areas.

every **SPECIAL** *Job!*

- mold cured portable cord
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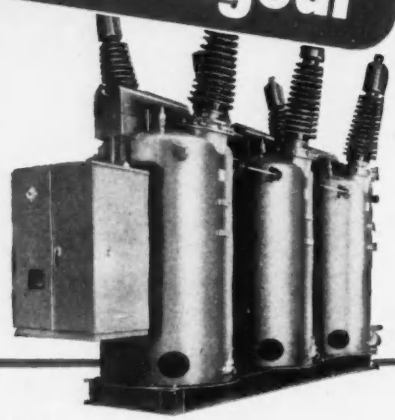
UNITED STATES STEEL

RELIABILITY

In Large Circuit Breaker Operation Depends Upon

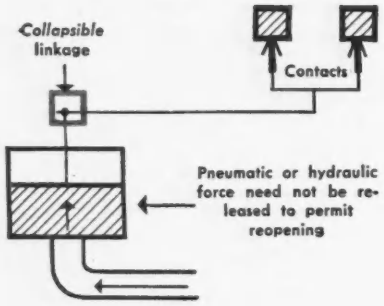
THIS BASIC DIFFERENCE

ALLIS-CHALMERS PROGRESS IN Switchgear



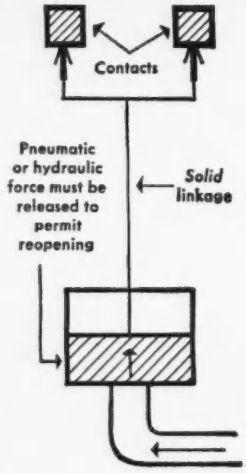
Allis-Chalmers *Mechanically Trip-Free* Mechanism

When opening after closing against a fault, the Allis-Chalmers operating mechanism does not require dumping of oil or air pressure. Trip coil simply releases a latch and the closing linkages collapse, allowing contacts to open at full speed. Operation is fully mechanically trip-free.



Other Operating Mechanisms

Air or oil pressure used to close contacts must be dumped — fast—to permit contacts to open. To do this takes a whole sequence of devices, including valves and solenoids. Everything must work perfectly. Otherwise breaker will be held closed or slowed in opening.



Opening the breaker when it closes against a fault, regardless of the position or condition of the closing mechanism, is the protective function of the breaker. To be fully protective under all circumstances, every one of your breakers should have a fully mechanically trip-free mechanism. For further details on what mechanically trip-free operation means to you, call your nearby Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4166

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aluminum FASTENINGS...

IMMEDIATE DELIVERY!

Because of its high relative strength and resistance to corrosion, aluminum alloys are receiving greater and greater emphasis in the electrical industry. In the complete H. M. Harper line of Everlasting Fastenings, you will find aluminum machine bolts, carriage bolts, cap screws, machine screws, wood screws, nuts, washers and rivets in sizes to meet practically every need of the electrical field.

Besides aluminum, H. M. Harper manufactures and stocks over 7,000 different Everlasting Fastenings in brass, naval bronze, silicon bronze, copper, nickel, Monel and all stainless steels. Harper's long experience in working with corrosion-resistant metals assures you of the proper fastening to solve any corrosion problem. Harper metallurgists and engineers are available to assist you in designing special fastenings to meet your needs.

Call the Harper branch office nearest you or mail the coupon.

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8205 Lehigh Avenue, Morton Grove, Illinois

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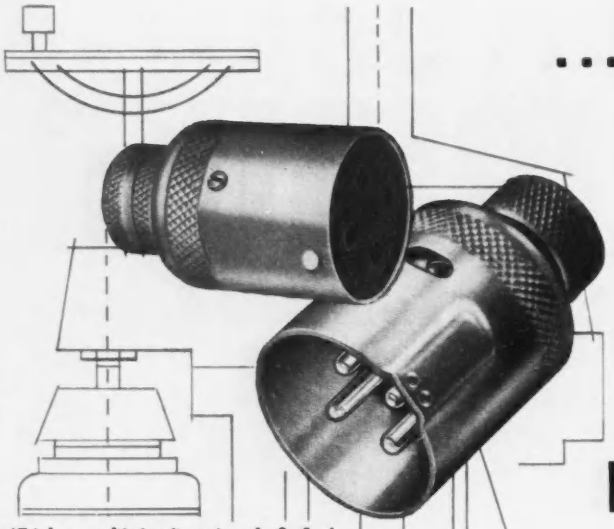
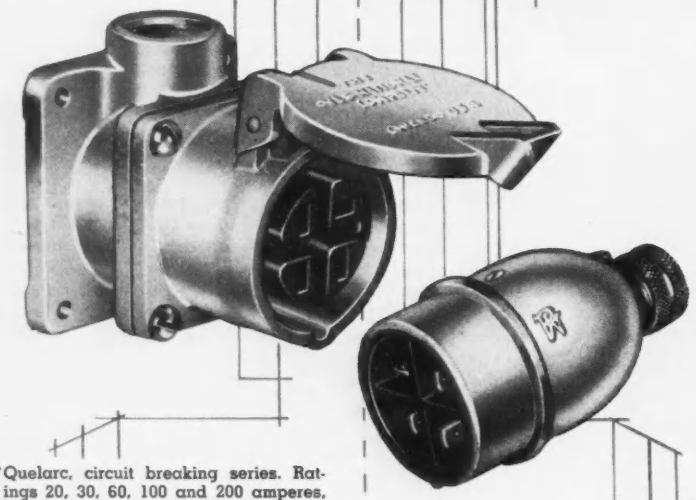
PLUGS and RECEPTACLES

- *Shorten out-of-service time*
- *Assure proper reconnection*
- *Save time and labor*



*Triploc, multi-circuit series. 1, 2, 3, 4, 6, 8, and 12 pole contact units interchangeable and reversible in any single set of housings. Housings of pressed steel with automatic lock or of cast metal threaded for watertight gasket seal. 2, 3 and 4 gang unit types for up to 48 poles also available.



*Quelarc, circuit breaking series. Ratings 20, 30, 60, 100 and 200 amperes, 250 volts d.c., 600 volts a.c. 2, 3, and 4 pole. Threaded cap, plain and hinged spring door housings.

*Trademark Reg. U.S. Pat. Off.

Pyle-National's safe, easy-to-handle heavy-duty plugs and receptacles quickly pay for themselves when used for connecting motorized valves or any other electrical equipment that must ever be relocated or disconnected for inspection or repair.

These prepolarized connectors not only eliminate the labor expense involved in disconnecting individual wires from junction boxes (or breaking soldered connections) and marking wires and terminals, but in addition, cut to a minimum the length of time valuable equipment is kept out of service.

The multiple-pole TRIPLOC series will handle any combination of power and control circuits. The heavy-duty QUELARC series will handle loads up to 200 amperes. Indeed, there is a Pyle connector for every application, including an explosion proof series for hazardous locations. Write for detailed literature.

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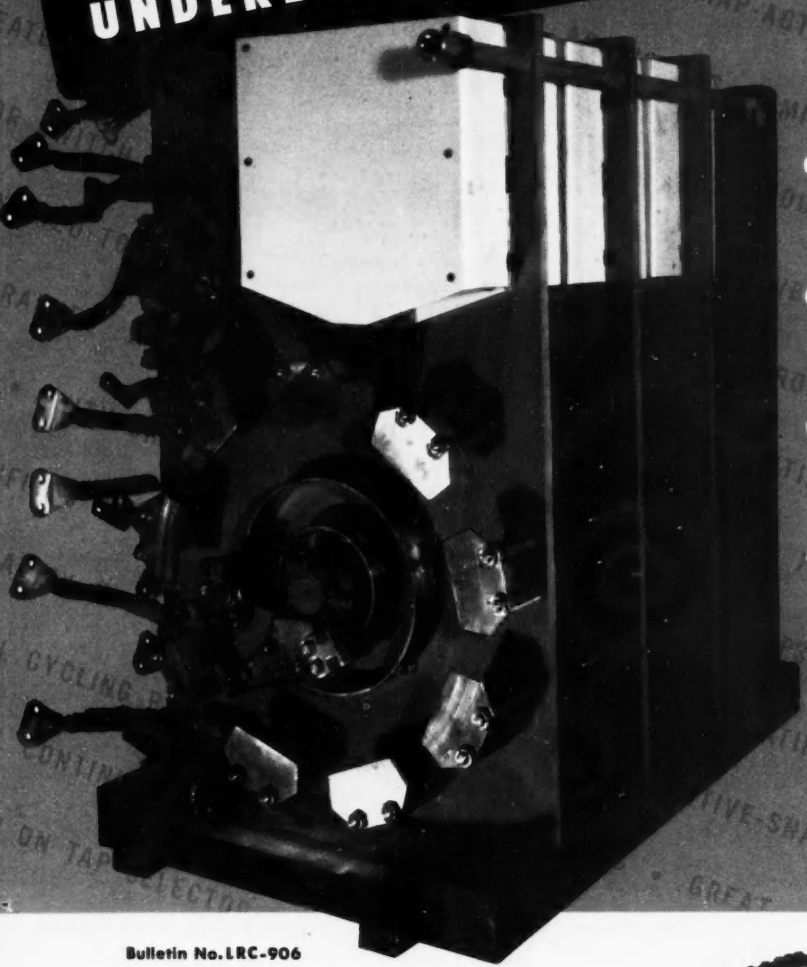
MOLONEY ELECTRIC

UNDERLOAD TAP CHANGER EQUIPMENT



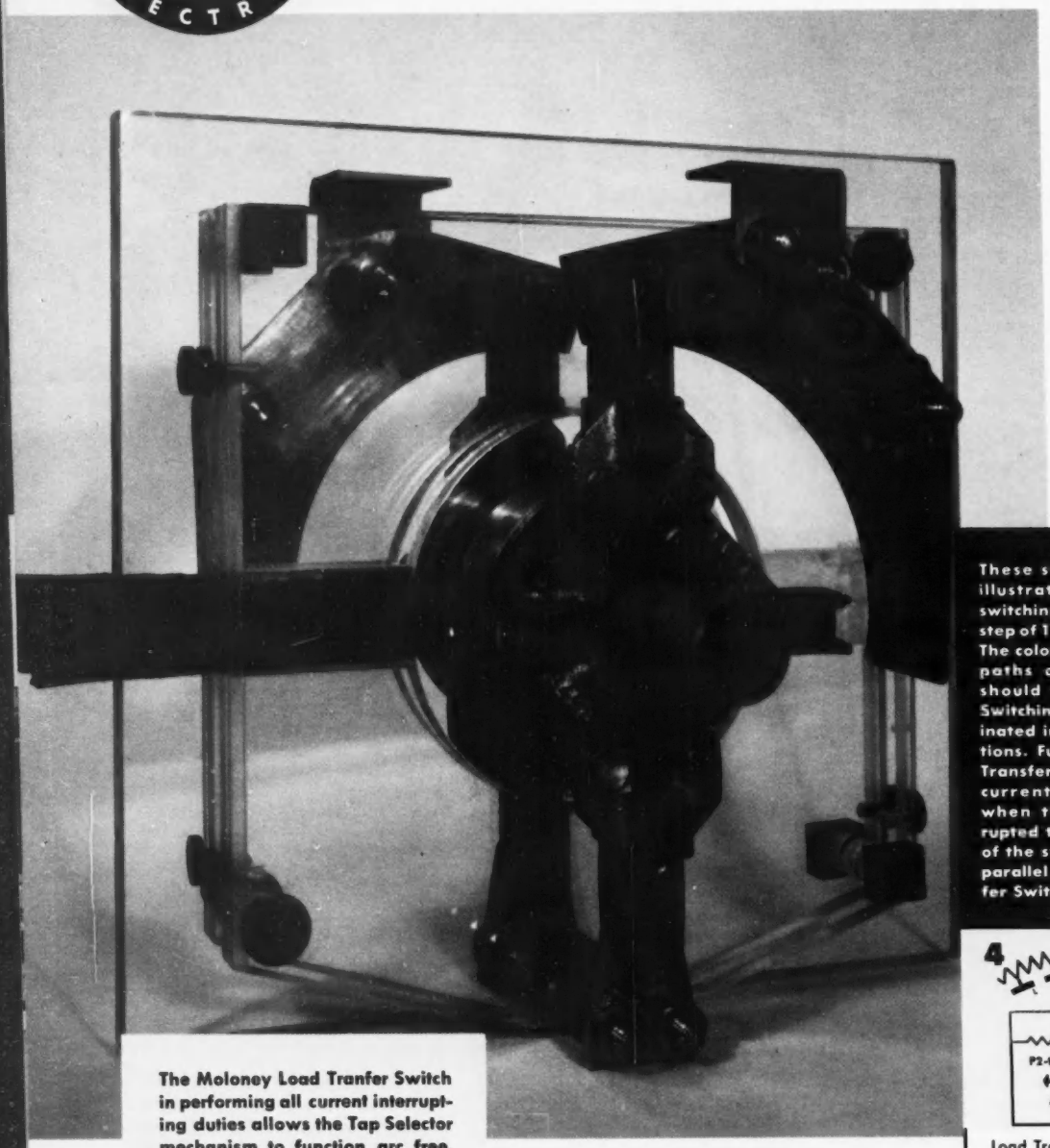
as applied to

- STEP VOLTAGE REGULATORS
- REGULATING TRANSFORMERS
- LOAD RATIO CONTROL TRANSFORMERS
- PHASE SHIFTING TRANSFORMERS
- SPECIAL APPLICATIONS

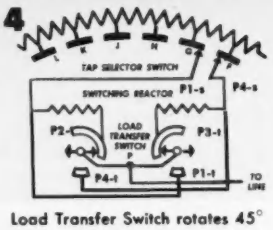
Bulletin No. LRC-906

MOLONEY ELECTRIC COMPANY

EXCLUSIVE



These schematic diagrams illustrate the sequence of switching for one regulator step of 1¼% of rated voltage. The colored lines indicate the paths of load current. It should be noted that the Switching Reactor loss is eliminated in all 1¼% step positions. Furthermore the Load Transfer Switch performs all current interruptions and when the current is interrupted the alternate portion of the switching reactor is in parallel with this Load Transfer Switch.



Load Transfer Switch rotates 45° counter-clockwise causing current to flow through both halves of reactor. Load Tap Changer is now in bridging position which is Operating Position No. 2 on ⅝% step apparatus and tap change has been completed. On 1¼% step apparatus this is a transitory position.

The Moloney Load Tranfer Switch in performing all current interrupting duties allows the Tap Selector mechanism to function arc free. The Load Tranfer Switch is ruggedly constructed to afford a low overall current density and is tipped with a copper tungsten alloy to minimize the deteriorating effects of arcing. In addition, the Load Transfer Switch contacts are subject to but half the arcing duty imposed on other types of equipment because the arcing is distributed over 4 points instead of 2.

The Moloney Underload Tap Changer is a self contained mechanism highly flexible for adaptation to many special applications. The Moloney Engineering Facilities are available for consultation and suggestions concerning special problems which arise from unusual operation or installation conditions.

MOLONEY ELECTRIC

PRINCIPLE

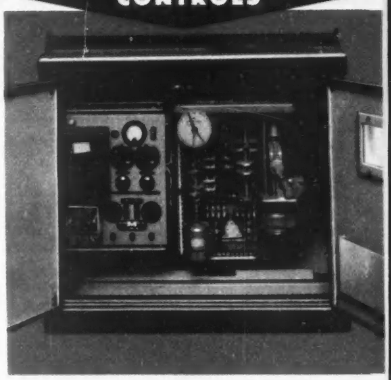
OF REACTOR BY-PASS SWITCHING

The Underload Tap Changer is the heart of all Moloney Regulating Equipment. It combines the duties of a circuit breaker and a tap selector to give continuous voltage regulation under varying load conditions without service interruptions. It functions perfectly day in and day out, performing thousands of operations with little or no maintenance.

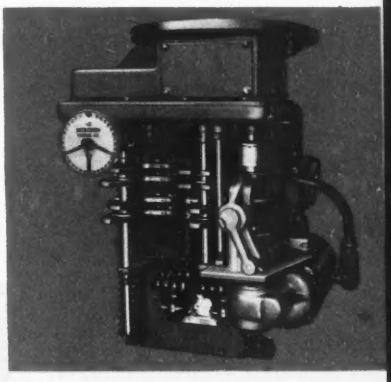
Moloney Engineers in producing a switch that isolates all current interrupting duties have made available the exclusive reactor by-pass switching, which eliminates reactor loss and voltage drops on full cycling positions.

53ME-44

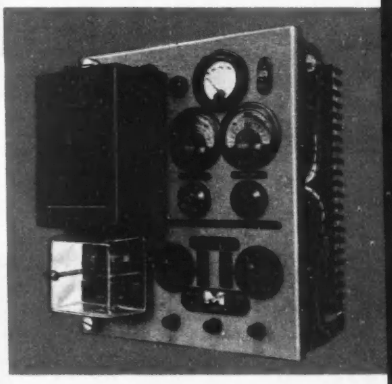
DRIVE MECHANISM AND CONTROLS



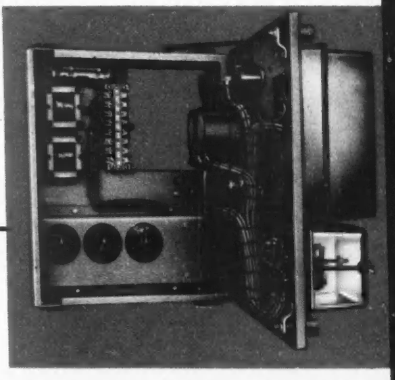
Installed Drive Mechanism and Control Panel



Drive Mechanism, Position Indicator and Operation Counter

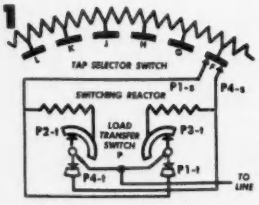


Automatic Control Equipment Panel



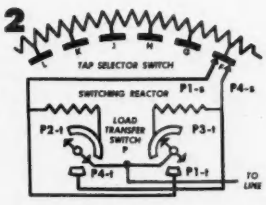
Interior View of Automatic Control Panel Showing Line Drop Compensator

1



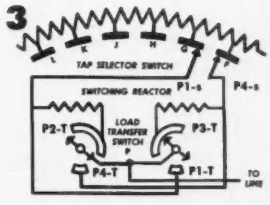
Switch positions for Load Tap Changer Operating Position No. 1 on either ⅝% or 1¼% step voltage regulating apparatus (assuming Reversing Switch is in Buck position). A 10% voltage buck is provided in this position. Note that reactor is by-passed.

2



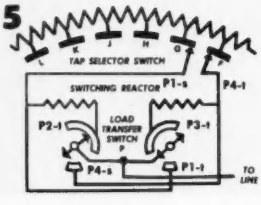
Assuming there has been an increase in load and the line voltage decreases, the Automatic Control, after a time delay, actuates the driving motor. The motor drive mechanism rotates the Load Transfer Switch 45° counter-clockwise, shunting all of the current through one half of the Switching Reactor.

3



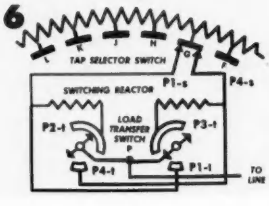
While the Load Transfer Switch remains in the position shown in Fig. 2, the motor drive mechanism continues to operate and rotates the Tap Selector Switch to the bridging position illustrated above. No arcing takes place since no current is flowing through moving contact P1-s.

5



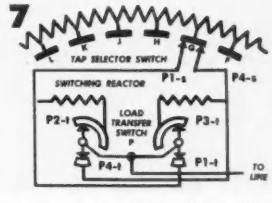
On 1¼% step apparatus the motor drive continues to operate and rotates the Load Transfer Switch 45° counter-clockwise, again shunting all of the current through one half of the reactor in preparation for the movement of the Tap Selector Switch to its next position.

6



With no current flowing through moving contactor P4-s, the Tap Selector Switch now moves to the next position with P1-s and P4-s on stationary contact G.

7



Next, the Load Transfer Switch rotates 45° counter-clockwise to complete the tap change. There is no reactor loss since the current flows through parallel by-passing circuits P1-s, P1-t, P and P4-s, P4-t, P to the line. Load Tap Changer is now in Operating Position No. 2 on 1¼% step apparatus.

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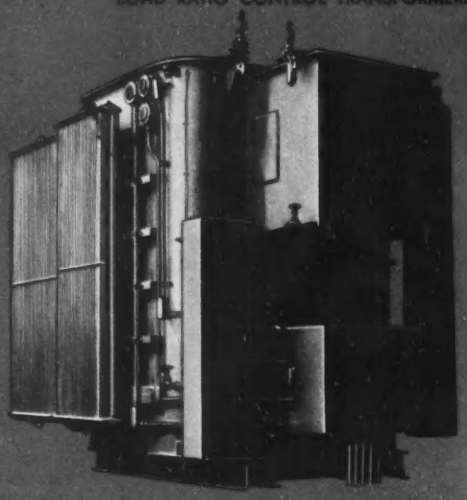
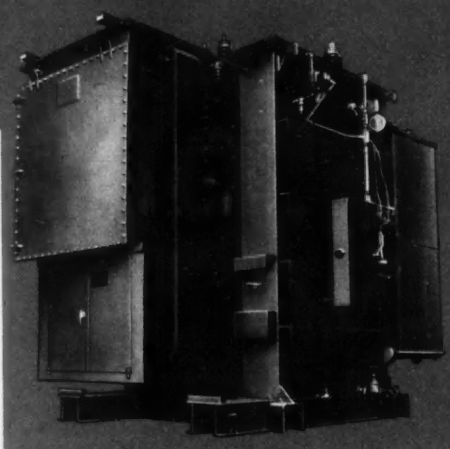
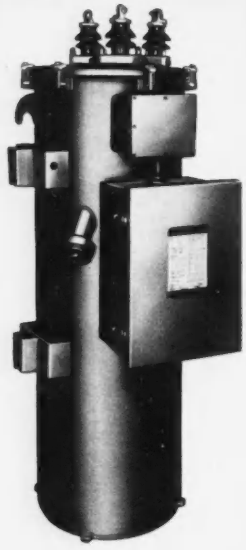
LOAD RATIO CONTROL TRANSFORMERS

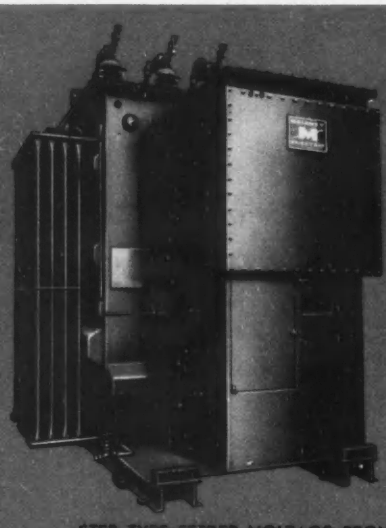


REGULATING TRANSFORMERS

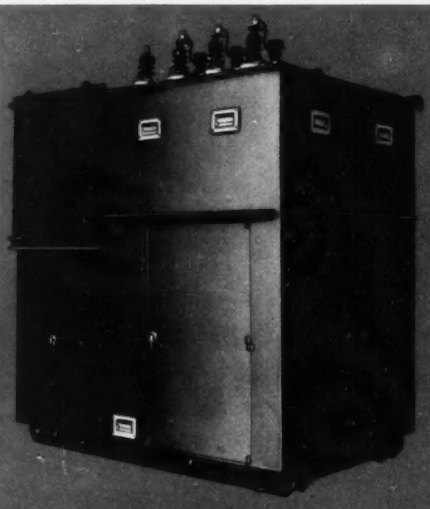




SINGLE-PHASE POLE TYPE
FEEDER VOLTAGE REGULATORS



STEP TYPE FEEDER VOLTAGE REGULATORS



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The New Power Policy: A Second Look

When the Interior Department issued its new power policy statement on Aug. 18, representatives of both public power groups and power companies showed strikingly mixed feelings. Some professed to like the new policy a great deal; others took a less optimistic view; and a few condemned it. The great questions were: What did this new policy mean? What changes would it bring about? How would the policy be interpreted in practice?

Answers are beginning to take shape. Some felt the statements of Aug. 18 were marked by a certain lack of clarity. But since then a number of Interior's top executives have made a series of carefully worded speeches "for the record." As the original policy statement seemed to be a framework of general principles—not a detailed blueprint—it is in these speeches that one must look for the new policy's inner core of meaning.

A study of these pronouncements leaves one with two broad conclusions. First, the administration states unequivocally its intention to give all power consumers, of whatever character, as fair an opportunity as possible under existing laws. Second, there appears to be ample opportunity for further study of those policy areas where some believe that complete clarity and equality of treatment are yet to be achieved.

As to the first conclusion, policy speeches by Secretary McKay, by Solicitor Davis, and by Assistant Secretary Aandahl, and the original statement as well, have emphasized such principles as these: The policy set forth rests firmly on the foundation of Congressional legislation; in this sense the policy is "old" and not "new." The government has no authority to go into the power business as such. The primary responsibility for supplying the power needs of an area rests with the people of that area. The Interior Department has no "exclusive" rights. When federal power is marketed, the rights of the ordinary citizen and taxpayer must be kept in mind.

Now as to the second conclusion, the need for further study, this may be illustrated by the restatements of the preference system. In reasserting the principle of preferential treatment, administration spokesmen have done much to remove some of the heavy overtones of special favoritism so evident in the past. And yet as the present preference system is the result of changing and rather complicated historical development stretching back nearly 50 years, it is certainly fair to suggest that further study of this problem rather than a mere restatement of the principle could produce beneficial results for all consumers of electricity.

We recognize political reality and the manifest difficulties of correcting in one fell swoop all the inequities which crept into the preference concept during a good many years. But we think no one should object to the suggestion that further study of this and other policy areas seem essential. In this continued study, we believe that the many imaginative leaders of the electric industry can be of considerable help, as indeed can anyone else who can contribute to solution of the problem of where and how this nation gets its power.

It is therefore to be hoped that the administration will not regard its policy statement as a piece of "finished business," that further study will be carried on, and that suggestions from all interested parties will be welcomed. The problem is complex and takes time. But men of good will, working together, can find a solution.

Opportunities in Industrial Space Heating

Last winter a cooperative industrial space heating campaign was conducted by a Midwest utility and a local distributor of electric industrial space heating equipment. It consisted of a modest direct mailing of manufacturer's literature (with return card) to 1,000 industrial accounts. Actual sales resulting through the spring of 1953 from this activity amounted to 24 installations with a connected load of 114 kw and 46 active prospects with whom negotiations are still going on. Such results give an indication of the interest in this type of heating.

A Pennsylvania utility recently conducted a promotion on electric radiant industrial comfort heating using an inexpensive unit designed for ovens. A number of installations were made during the last heating season, and the results were very encouraging. In almost every case the benefits, savings, added comfort, lack of fumes, etc, outweighed the cost of equipment and operation. It believes that the results would have been even better if a low density, large radiating surface type unit had been used.

For the user electric space heating has many benefits. The lack of fumes makes it ideal for workers with sinus or other nasal disturbances. It is safe, clean, and low in maintenance. It is ideal for those hard-to-heat "spot" locations—especially near the floor under and around machinery. Each location or area can be easily and inexpensively controlled by thermostat. Isolated areas or buildings remote from the central heating plant are a natural for this type of heat. In some cases not only the installation cost but also the cost of operation is comparative with or even lower than that of conventional heating systems and equipment.

For the utility industrial space heating does not usually require additional utility service facilities. In view of its diversified load characteristic, off-peak operation possibilities, automatic load control, high power factor, etc, the existing utility service would be sufficient in many plants to accommodate a considerable space heating load.

Some plants carry boiler room operation through spring and fall seasons just to furnish the small amount of steam required for space heating. In a large percentage of industrial plants their substation and distribution facilities would carry the additional load without need for heavying up. In the newer plants having load center distribution, bus duct, etc, the addition of electric space heating equipment would require little, if any, additional feeders, transformer capacity, or circuits. The average plant has sufficient diversity and spare capacity to accommodate considerable space heating loads.

Utilities should investigate these opportunities for increasing industrial loads.

Farm Electrification Is Not a Self-Starter

"The job of research is to help the farmer make his production methods as modern and efficient as those of a factory."

So spoke Ancher Nelsen, REA administrator, at the 1953 National Farm Electrification Conference, held recently in Washington. At the same meeting, C. N. Ferguson, director, Agricultural Extension Service, Department of Agriculture, presented a graph showing, over a number of years, the increasing amount of agricultural research being done, and the much slower growth of application of the results of that research in farm operations. Between the two curves of the graph there was a wide gap.

Also at the same meeting a most interesting comment was made during the general discussion period. It was to the effect that farm electrification, such as it is and as far as it has gone, has been forced on the farmer by the cost and scarcity of farm labor, rather than welcomed by him as a profit maker.

Apparently the farmer is in no great hurry to "make his production methods as modern and efficient as those of a factory." If this is so, and plenty of evidence says it is in respect to electrification at least, it is no reflection on the farmer's intelligence. He has just not been shown that electrification will benefit him in the pocketbook. The reflection is on the collective gray matter of the electrical industry which as yet has not grasped its own opportunity for profit by showing the farmer that its goods and services will make a profit for him.

As yesterday's factory operator had to be shown by selling that electrification would make money for him, so today's farmer must be shown. Selling is the force needed to narrow the gap between agricultural research and application of its results. Without selling, agricultural production methods will never become as modern and efficient as those of a factory.

Pocketbook of Industry Statistics

Edison Electric Institute has again revised the handy booklet entitled "EEI Pocketbook of Electric Industry Statistics." This booklet provides a fine service to the industry. Those who make use of it are in a much better position to assist in informing the public about our great industry. It is hoped that each employee in the electrical industry will have one at his disposal. You can secure a copy at a moderate price from Edison Electric Institute, 420 Lexington Avenue, New York 17, N. Y.

Electricity or Electry?

Paucity, plasticity, obesity and even serendipity are all nice words and they all end in "ity". But they are a state or a condition derived from a corresponding root word.

So the question is a fair one, why have to be so consistent as to emulate the process in deriving electricity (noun) from electric (adjective). Energetic and not energicity comes out of energy. Likewise the argument is that electricity pertains to an art like chemistry and metallurgy so why not merely tack on the "y" and not the "icity" to the stem "electr".

It makes for a certain amount of sense but hardly for euphony. But in linguistics the euphony usually overrides the sense and the rigor. The Teutons and Scandinavians seem to absorb their "elektrie" with a minimum of vocalistic discombobulation but the Americans are likely to stick to "electricity" even if it does carry a supercargo of terminal syllables. More power to the Germans if Oscar Kohnle of Uberlingen can get them instead to veer away from "elektricitaets" which must be a real mouthful even for the Germans.

THE ELECTRICAL WEEK

The Issue's News Highlights—New York State Power Authority steps up engineering planning for St. Lawrence project after President designates agency as U. S. partner in joint U. S.-Canadian hydro development.

Interior Department is seeking dismissal of government's appeal for a review of FPC orders granting permits to Pacific Gas & Electric and Fresno Irrigation District for hydro developments on King's River in California. . . . FPC cancels hearing on proposed WWP-Puget Sound merger.

James H. Jewell, Westinghouse Electric Corp, was elected president of National Electrical Manufacturers Association at Nema's annual convention in Atlantic City. Vice presidents elected were: Hoyt P. Steele, Benjamin Electric Manufacturing Co; William A. Elliott, The Elliott Co; Frederick F. Loock, Allen-Bradley Co; James W. Corey, Reliance Electric & Engineering Co; and James L. Busey, General Electric Co. A. F. Metz, president of Okonite Co, was named treasurer.

Great Britain will establish on Jan. 1 a governmental atomic energy corporation to find the quickest and most economical way to build and operate nuclear power plants. The Marquess of Salisbury, Lord President of the Council, will be responsible for its organization. Sir Edwin Plowden, until Nov. 1 chairman of Economic Planning Board, will be first chairman of its executive board.

Public Relations—ECAP will drop radio for television in 1954. The semiweekly TV show, "You Are There," will be carried by 21 additional stations for a total of 85. Radio show, "Meet Corliss Archer," will be dropped.

Engineering studies are under way for possible absorption of Mountain States Power by Pacific P&L, Wall Street sources report. Asked for comment, Pacific P&L Pres Paul B McKee said, "No such thing is happening or even under consideration."

Nine journalists representing newspapers, press services and EW surveyed the Niagara power site last week as the first stop in an NAEC-sponsored tour of the nation's controversial power areas. At the Falls they heard Earle J. Machold, president of Niagara Mohawk Power Co, say he felt the Senate Public Works Committee would act favorably on the Capehart-Martin-Miller (private development) Bill at the next session of Congress and that the bill would receive "the same overwhelming approval" by the Senate.

For the second time in 22 years the 8,400 employees of New England Electric System in October completed a month's work—1.5 million man-hours—without a lost-time accident.

Construction of power plants in Colombia has been centralized in an electric power bureau which will plan, design, and build smaller village plants and have control over them when they have been turned over to the villages. Before this, the bureau was concerned only with investments in larger plants.

Off the Washington Wire — Former President Hoover steered clear of power company people in appointing the 26 members of his new commission's task force on water and power resources. There isn't a single representative of privately or publicly owned utilities on the entire list, which includes 13 engineers—many of them consultants. But the character and past performance of the appointees give ample assurance that power companies need have no fear of the recommendations the task group will make to the commission.

Harrison Williams, wealthy utility executive once said to control one-sixth of all American public utilities, died Nov. 10 at Bayville, L. I., at the age of 80. SEC began breaking up Williams' empire. topped by North American Co, under the Holding Company Act of 1935. In recent years, though he remained chairman of the North American board, Williams shifted funds to American G&E, of which he became a member of the board.

Duquesne Light Co, Pittsburgh, Pa., will refund $3.7 million in overpayments and interest to 414,000 consumers in Allegheny and Beaver Counties as a result of an order from the Pennsylvania PUC. Refund represents a rate reduction originally ordered by PUC in 1951.

Washington State Game Commission and Department of Fisheries will appeal to the U. S. Supreme Court to reverse a ruling by a state court of appeals that City of Tacoma has the right under federal license to build two hydro dams on the Cowlitz River. Sportsmen contend the dams would destroy the state's last good salmon-spawning area.

Three utilities are planning to register a total of $80-million in bonds with SEC. The companies and the amounts: Consolidated Edison, $35 million; Appalachian Electric Power, $20 million; and Public Service of Indiana, $25 million.

From the Southwest—Drought and falling cattle prices have had almost no effect on revenues of the larger power companies here. In one or two cases, increases were slightly under last year.

Wisconsin P&L received SEC approval to acquire all outstanding capital stock of Interstate Power Co of Wisconsin for $2,359,730. The two companies are not affiliated.

West Penn Power Co asked FPC approval to acquire Natrona P&L facilities in Allegheny County, Pa., for $508,000 . . . Lake Superior District Power asked the commission to let it absorb its subsidiary, Northern Wisconsin Power.

Congratulations—Houston Lighting & Power has elected W. Alvis Parish president, and W. J. Aicklen and T. H. Wharton executive vice presidents . . . W. V. Drake was promoted from assistant vice president in charge of power production of West Penn Power to vice president . . . Joseph A. Busch, formerly assistant to the vice president in charge of sales for Northern States Power, was appointed a vice president of the utility.

Plans for St. Lawrence Move Ahead

N. Y. Power Authority retains two engineering firms after Eisenhower designates agency as U. S. partner with Canada

JEROME KUYKENDALL

New York State Power Authority last week was pushing engineering plans for the 1,881,000-kw hydroelectric project it will build in conjunction with the Hydro-Electric Power Commission of Ontario on the St. Lawrence River. Power produced at the $600-million joint project will be shared equally by the United States and Canada.

The New York agency has named two engineering firms, Sanderson & Porter, New York, and Charles T. Main, Inc., Boston, to direct construction of the New York half of the power project. The firms last week began working with the authority's engineers in reviewing and revising Army Corps of Engineers' St. Lawrence plans of 1942. It is expected this process will require six months before actual construction can begin on a large scale.

Go-Ahead Signals

Recent developments which have made it possible for the State Power Authority to proceed full speed with its St. Lawrence plans are these:

- State Power Authority accepted on Nov. 3 a Federal Power Commission license issued July 15 to go ahead with the project.
- President Eisenhower Nov. 4 signed an executive order designating the New York power agency as the U. S. partner with Canada in developing the power potential of the St. Lawrence River. At the same time the President named Secretary of the Army Robert Stevens and FPC Chairman Jerome Kuykendall as American members of the St. Lawrence River Joint Board of Engineers.
- Attorney General Herbert Brownell Nov. 6 filed a motion in U. S. Court of Appeals on behalf of FPC asking for expedition of court action on litigation opposing construction of the St. Lawrence project.

Suit filed by Pennsylvania Coal Producers Association, Lake Ontario Land Development and Beach Protective Association, and Public Power & Water Corp, Trenton, N. J., in Court of Appeals to have the FPC license set aside is the only remaining obstacle to the start of actual construction of the project by New York and Ontario.

FPC to Defend Order

Lawyers for the federal government plan to push the St. Lawrence case through to a Supreme Court decision before the court's present term ends next June.

As charged by law, FPC lawyers will carry the responsibility of defending the FPC order, with possible assistance from Justice Department attorneys. The government lawyers already have decided not to move for dismissal of the petition; to do so merely would consume time and delay the decision they seek. They hoped the Court of Appeals would advance the case and hold hearings about the middle of December. A decision then could be expected by the middle of January and the case could be carried to the Supreme Court for a final opinion before the summer recess.

In transmitting his plea for expedition of the litigation, Brownell sent along a letter he had received from Secretary of State John Foster Dulles relaying wishes of Canada to go ahead with work as soon as possible.

An aide of John Burton, chairman of the State Power Authority, called the pending suit "a delaying action." If the final court decision validates the license, the Power Authority will take bids and then issue bonds to finance construction. During the FPC hearings, U. S. share of the cost of the project was estimated at $316 million.

Investment firms of Harriman Ripley & Co, Lehman Brothers, R. W. Pressprich & Co, and Union Securities Corp will handle the financing. It is not expected that these bond houses will underwrite an issue while legal questions remain before the courts.

License granted the Power Authority covers construction of a dam and powerhouse at Barnhart Island in the International Rapids section of the St. Lawrence between Massena, N. Y., and Cornwall, Ont., and another dam 27 miles upstream from that point.

It is estimated that the U. S. share of power generated at the project will add 10% to the power supply now available to New Hampshire, Vermont, the eastern two-thirds of New York, and southern New England. FPC has reserved the right to pass on allocations made by the New York power agency to insure right of neighboring states other than New York to get a share of the power.

In issuing the license FPC denied requests of public power groups that preferential treatment for public bodies and cooperatives be imposed as a condition of the license.

ROBERT STEVENS

Interior Asks Appeal Dismissal

Court urged to throw out government's request for review of FPC grants for local hydro developments on King's River

Interior Department last week gave added confirmation to its power policy statement of Aug. 18. At the behest of Interior, the Justice Department asked the 9th Circuit U. S. Court of Appeals in San Francisco to dismiss the government's appeal for review of Federal Power Commission orders granting: (1) two licenses to the Pacific Gas & Electric Co to develop hydro power on the Kings River in California, and (2) a preliminary permit to the Fresno Irrigation District to study the feasibility of installing generators at Pine Flat flood-control dam now being completed by the Army Corps of Engineers on the Kings River below the junction with the North Fork.

Dismissal Expected . . . Dismissal of the case, slated to begin today (Nov. 16), appeared to be a foregone conclusion. All other parties to the suit —Pacific G&E, Fresno ID, and FPC —concurred with the United States in requesting dismissal by the court. The first two joined with the federal government in the request, while FPC mailed its parallel request to the court from Washington.

More than $80 million of construction and 200,000 kw of hydro generating capacity were wrapped up in the case. Two licenses to Pacific G&E —to be issued after the company gets satisfactory agreement with irrigation interests on use of Kings River waters —would authorize enlargment of an existing hydro plant and construction of additional reservoirs and power plants costing more than $75 million. These would develop an effective head of nearly 3,000 ft and add 274,000 kw in new generating capacity.

Under its preliminary permit, the Fresno ID would seek to determine the practicability of installing initial capacity of 45,000 kw at Pine Flat Dam. This installation would cost more than $5 million.

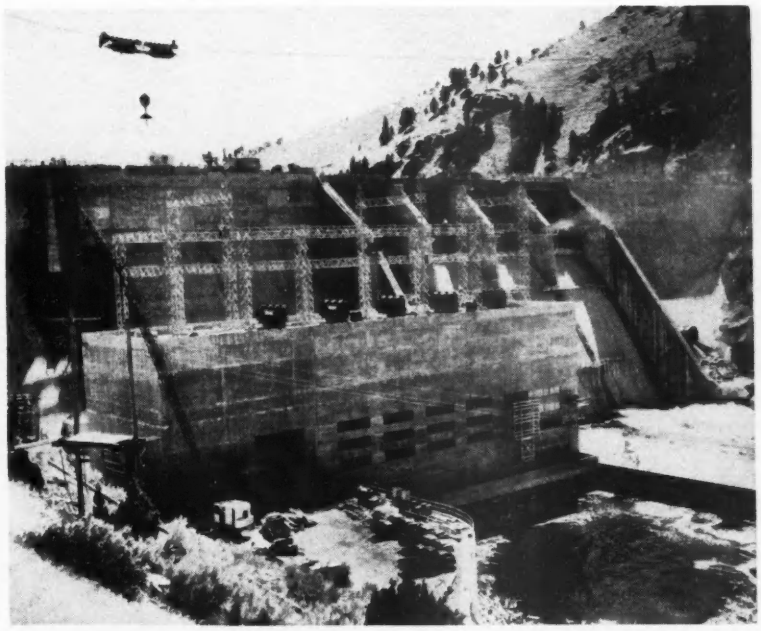
Time Limits Set . . . FPC orders to both PG&E and the Fresno ID set time limits on the licenses and the preliminary permit and, further, specified that the time periods were to begin only after the orders had been validated by the courts. For PG&E, the time limit is six months in which to work out agreements with irrigation interests. However, the FPC could grant extensions. Fresno ID has two years to complete investigations and file a license application with FPC to construct the generating station at Pine Flat.

Kings River hydro development has been tied up in a long hassle. PG&E some years ago applied to FPC for licenses (1) to enlarge its existing Balch plant on the north fork of Kings River, (2) install generators at Pine Flat and (3) build additional hydro plants. About the same time, Fresno ID asked FPC for a preliminary permit blanketing the same watershed. Concurrently, the Reclamation Bureau began submitting reports for developments that practically duplicated the other two plans.

Chapman Protests . . . FPC ordered licenses for PG&E and a preliminary permit for Fresno ID. Then, in 1952, Oscar Chapman, former Secretary of Interior, filed objections on the ground that all the projects should be built by the federal government.

After long hearings, FPC overruled objections of the Interior Department, which then took the case to court. Since the coming of the McKay-Tudor-Aandahl-Davis team to Interior, the Department has had the case under study. Recently it advised the Attorney General to request dismissal.

Interior based its advice on the Supreme Court decision on the Roanoke Rapids Case. Backing its opposition was the history of Kings River bills introduced in Congress. Moves to authorize federal development of the river have come before Congress nine times without success.



Switchyard Rises Atop Power Plant

Steel structure and power equipment being erected on top of powerhouse is the new switchyard for power plant of Canyon Ferry Dam, Mont., a multi-purpose project of the Bureau of Reclamation. The plant will house three generators rated at 16,667 kw each. First generator is scheduled to go on the line this fall. Canyon Ferry Dam's crest length is 1,000 ft, rising 225 ft above foundation on bedrock. Construction of the dam and powerhouse is estimated to cost about $11,896,425.

Hearing Off

FPC cancels Nov. 9 session on merger of Washington Water Power and Puget Sound P&L

Hearing before the Federal Power Commission on the proposed merger of Puget Sound Power & Light Co with Washington Power Co has been cancelled subject to further order of the commission.

FPC action resulted from a request from five PUD's for postponement of the Nov. 9 hearing. The PUD's oppose the merger and are seeking to purchase Puget P&L properties for themselves. In another development the PUD's appealed to the courts the decision of Washington Public Service Commission approving the merger.

Termination Date . . . In its request for postponement of the hearing the PUD's pointed out that the merger agreement between the two companies would terminate Nov. 19, under its own terms, if the merger were not consummated by that time.

WWP noted that this consummation date had been extended once by the two parties and could be extended again. Kinsey Robinson, WWP president, expressed confidence FPC would set a hearing date as soon as the merger deadline had been extended.

FPC pointed out that no evidence has been presented that the Nov. 19 termination date had been extended "nor have any unequivocal representations been made that it will be."

Puget Power last week had made no statement that it would agree to extension although such decision could be made on short notice.

Review Scheduled . . . In granting the PUD's a writ of review of the PSC's decision on the merger, Thurston County Superior Court Judge Charles T. Wright directed the commission to furnish records to aid in a determination of legality of its order approving the merger. Dec. 3 was set as the date for the commission to report.

Harvey Benson, chairman of the executive committee representing the five PUD's said the recent intervention of a stockholder committee, made up principally of representatives of investment banking houses, shows that the proposed merger is being promoted by stock brokers interested in securities operations.

Winne, Clark Are Honored

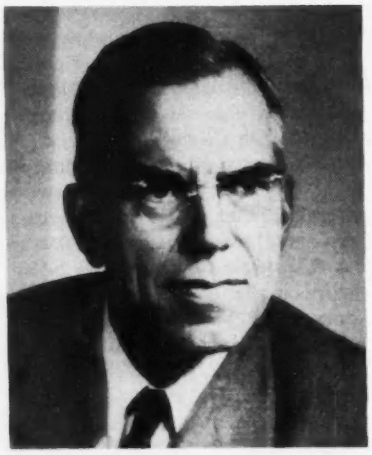
Electrical men receive James H. McGraw Awards at Nema meeting. Association names new board members, division heads

Two awards voted by the Committee of the James H. McGraw Award for Electrical Men were presented to Harry A. Winne, General Electric Co vice president, and Bonnell W. Clark, former vice president of Westinghouse Electric Corp, at a luncheon meeting of National Electrical Manufacturers Association held last Wednesday in Atlantic City, N. J.

The Manufacturers Medal went to Winne in recognition of his "outstanding industrial statesmanship contributing to the advancement of the electrical manufacturing industry in the fields of engineering and nuclear research." He has served as chairman of the advisory committee of the Hanford Works.

Clark, who has headed the Electrical Equipment Section of the National Production Authority since 1951, received the Medal for Co-operation for his "outstanding accomplishments in the great task of mobilizing the resources of the electrical industry to the service of the nation."

Seven new full-term members of the Nema board of directors were elected at the Convention. They were: J. E. Bixler, president, Duncan Electric Manufacturing Co; M. A. Chapman, president, Mica Insulator Co; J. J. Mullen Jr, president, Moloney Electric Co; J. B. Tinnon, vice president, Metal & Thermite Corp; Charles F. Mullenback, Mullenback Electric Co; Joseph S. Thompson, Pacific Electric Switchgear Co; and James F. Lincoln, Lincoln Electric Co.



HARRY A. WINNE

BONNELL W. CLARK

Wade Burleson, Ohio Brass Co, was elected to serve out a one-year unexpired term of Charles Swartzbaugh, Swartzbaugh Electric Co, who resigned.

R. A. Rich, vice president of Philco Corp, was elected chairman of the Major Appliance Division, and Laurance Messick appointed director for the National Lighting Bureau.

Fast Tax Write-Off Asked for 2 Snake River Dams

Idaho Power Co has formally applied to Office of Defense Mobilization for accelerated tax amortization on two of its three proposed Snake River projects: Ox Bow, $23,604,000; and Brownlee, $63,594,800.

ODM says action on Idaho Power's application is a long way off. For one thing, it can't do anything until the company obtains a Federal Power Commission license. For another, ODM is not authorized to grant fast tax write-offs to new electric power projects unless power generation is scheduled by Dec. 31, 1955, target date for its defense expansion program. An exception is made only for projects that will supply power to Atomic Energy Commission, and these must be in production by Dec. 31, 1956.

Interior Reaffirms Stand . . .

. . . that preference customers in Missouri Basin must make 20-year estimates of power needs by Jan. 1

The Interior Department has held fast to its power marketing criteria in the Missouri Basin. In a session with electric cooperative managers in Washington on Nov. 4, Assistant Secretary Fred G. Aandahl re-emphasized for the Reclamation Bureau that preferred customers must make estimates of their power needs for the next 20 years by Jan. 1.

The action preceded a meeting the co-op leaders had with President Eisenhower. The latter session was arranged after 100 co-op representatives in the ten Missouri Basin states had voted in Omaha to ask the President for a delay of one year in making the new regulations operative, or, failing that, to seek an injunction against the Interior Department.

After the session with the President, a spokesman for the group said, "We got no commitments on anything." In addition to the 20-year estimate requirement, the co-ops had objected to:

- Elimination of the "recapture clause" from contracts with private power companies. Under the old system, if power needs of preference customers increased, these needs were met by withdrawing power from non-preference customers.
- An increase in rates, since under the new policy, preference customers must pay costs on power they have reserved but are not using.

Policy Outlined . . . Aandahl told the managers attending an REA Power Management Conference that the estimates of preferred customers will be analyzed and contracts negotiated to dispose of added power coming in during the 20-year period. He explained that the department must go ahead promptly with contracts to bring in money that will start paying off the reimbursable features of the projects. Since he foresaw a problem in dividing the limited amount of power equitably, he invited those at the conference to name a committee to advise the department.

Quiets Fears . . . Aandahl stressed the fact that there is nothing in the new criteria to alarm the preference customers. New contracts do call for a minimum charge on capacity—intended to discourage a customer from contracting for more power than the customer can use. This capacity charge applies only as the power becomes available and then only on this basis: 80% of the contract amount the first year; 90% the second year; and 100% the third.

The assistant secretary urged preference customers to make estimates of power needs that would not be subject to the minimum charge. Some managers pointed out that a co-op might assume the risk of added costs for a few years under the minimum charge in order to have more low-cost government power in later years.

Existing contracts, Aandahl told the co-op leaders, will continue in effect until there is mutual agreement to change them. He added that long-time contracts with non-preference customers will be held up until the needs of preference customers have been satisfied.

Supreme Court to Hear Hanford Works Tax Case

The Supreme Court will hear arguments by General Electric Co and the government against a Washington State business and occupation tax imposed on GE's operation of the Atomic Energy Commission's Hanford installation. In upholding the tax last spring, the Washington State Supreme Court rules the tax fell on GE as a business corporation, not as an agent of the federal government.

But GE and the government argue that the 1946 Atomic Energy Act exempting AEC, its properties, activities, and income from any such taxation, includes the activities of AEC contractors and subcontractors.

More Power for New Hampshire

Ground was broken last month for a 40,000-kw steam unit which is to be installed in the Public Service of New Hampshire Schiller Station near Portsmouth. The $8-million extension will bring the plant's capacity to about 120,000 kw. The new unit is scheduled to be in service in 1955.

Onlookers on the right at the ground breaking operation included (left to right) Orville L. Evans, utility division manager; Roy Fancy, project superintendent for the general contractor; and Mayor Theodore Butler, Portsmouth.

'Missouri Case' . . .

. . . is revived as utilities appeal decision upholding lend-lease plan involving co-ops, SPA, REA

Legality of the proposed federal-cooperative power tie-up in Missouri is headed for another test in the federal courts.

If decided on its merits, the "Missouri case" could go a long way toward spelling out the legal limits of federal laws relating to rural electrification loans and marketing of federally produced power.

Appeal Decision . . . Nine Missouri electric companies which have been fighting the proposed co-op-federal tie-up since 1950 appealed the case to the federal Court of Appeals Nov. 5. The federal agencies had won the first round before a district court in Washington (EW, June 29, p 66).

As it heads for the high court, the case involves only the legality of a series of contracts between Southwestern Power Administration, Rural Electrification Administration, and five generating and transmission cooperatives. The co-ops are not parties in the case, although contracts negotiated by them form the key evidence.

Under the contracts, the co-ops borrowed some $55 million from REA for construction of transmission and generation facilities. These, in turn, were to be made available to SPA which would buy output of the plants and lease the transmission lines with an option to purchase them.

These contracts have been the target of both legal and legislative action. The situation is now so complicated that it is almost impossible to determine whether a decision from the court of appeals would have any practical effect on the SPA-co-op contracts.

Chronology of Developments . . . Here is what happened:

- A federal district court opinion filed June 17 upheld the legality of all of the contracts involved in the action brought by the nine Missouri companies.
- A report submitted in late July by a House-Senate appropriations conference committee sought to prohibit the use of any SPA funds for carrying out the terms of these contracts, and SPA was immediately ordered to cease carrying out its part of the contracts. This report was filed along with SPA's annual appropriations bill and interpreted as a specific limitation on SPA spending.
- In September the co-ops and SPA made a preliminary attempt to begin negotiation of temporary contracts which would not violate the injunction of the Congressional report.
- Central Power Cooperative of Linn, Mo., on Oct. 15 filed a suit in federal district court asking that SPA be made to carry out the contracts involving Central. (EW, Nov. 9, p 9).
- On Nov. 5 the nine electric companies filed a notice of appeal in a move to override the district court opinion of June 17.

Niagara Bill Campaign

Plans have been formulated to mobilize public support of the Capehart-Miller Bill for redevelopment of Niagara Falls by private enterprise. The movement, which has the support of the Schenectady and Poughkeepsie Chambers of Commerce and five major New York State electric power companies, aims at marshalling the support of New York State Chambers of Commerce and voters for the private enterprise plan. The plans also call for statewide showings during the next three months of the new film "The Niagara Story," which was produced by the Schenectady Chamber of Commerce.

California Senator Puts Unit on Line

Third unit at California Electric Power Co's Highgrove steam electric plant (above) was placed in service last month when State Sen Lawrence C. Phipps opened the valve of the 40,000-kw unit. Surrounding the white-haired senator in picture at left are (left to right) A. A. Lingo, Highgrove superintendent; Catherine Nugent; Mrs Phipps; and Albert Cage (pointing), Calelectric president.

Senator Phipps helped finance the start of Calelectric almost 50 years ago.

The new addition, largest of Highgrove's three units, was completed a year after start of construction and brings the plant's capacity to 100,000 kw.

System Fire Protection . . .

. . . is discussed by F. J. Schneider, Niagara Mohawk Power Corp, at EEI Electrical Equipment Committee meeting

Fire protection for an electric system must provide maximum freedom from loss or interruption by fire, said F. J. Schneider, Niagara Mohawk Power Corp. He spoke before the Edison Electric Institute Electrical Equipment Committee at its recent meeting in New Orleans.

Schneider cited as imporant requirements for fire protection:

1. Design of station and equipment to minimize fire hazard.

2. Rigid cleaning, inspection, and testing to detect dangers before breakdown.

3. Provision of adequate fire protection to extinguish accidental fires in early stages.

Reducing Fuel Hazards . . . Fuel hazards are reduced by proper design, good operating practices, and adequate fire protection, he said. He listed precautions for lubricating oil as:

1. Segregation of steam and oil lines.

2. Rugged oil piping with all welded construction, protected from physical damage.

3. High-pressure oil piping enclosed within low-pressure return, or in welded conduit drained to oil reservoirs .

4. Oil reservoirs and equipment remote from high temperatures.

5. Well insulated steam lines.

Turbogenerators are protected by automatic CO_2, water spray, or equivalent, Schneider said. He pointed out that purging with inert gas prevents fire and explosion in hydrogen-cooled machines. Transformer oil fires are constrained by barriers or cells and protected by automatic emulsifiers or water spray, he said.

Protection for Hydro Units . . . Modern hydro units are totally enclosed, well suited to flooding with CO_2, Schneider said. But older open or semi-enclosed machines can be protected by perforated ring water spray at both ends, he noted.

Good fire protection also needs organized and well-trained personnel, Schneider said. Practice with equipment and test runs are helpful, he added, as are meetings with local fire officials.

The fixed foam system offers possible fire protection at stations without adequate water supply, said R. M. Pennypacker, Philadelphia Electric Co. Cost must be evaluated and the risk of accidental discharge recognized, he said.

Tests with Foam Spray . . . Pennypacker described tests where transformer fires were extinguished by foam spray with only 500 gallons of water. Nitrogen cylinders provided the pressure to drive water from the tank through the foam generator. Approximately 200 gallons of oil were burned in each of two tests. Extinction occurred in 4.5 minutes in one test, 2.75 minutes in another, Pennypacker reported.

But foam has been found conductive, Pennypacker warned. He suggested automatic tripping of breakers to clear exposed-bushing transformers as part of an automatic foam system.

Evacuation of hydrogen from synchronous condensers to 29.2 in. mercury with vacuum pumps before admitting air is the basis of a new method described by A. Jenkins, Southern California Edison Co. A 3,600 cu ft shell requires 105 minutes to evacuate with trailer mounted pumps, he said. Then air can be admitted without creating an explosive mixture with remaining hydrogen.

The method has been used for two years, Jenkins said, 11 times to remove hydrogen and 14 times to fill with hydrogen. About 2.5 hours suffices for each operation, he said, compared with over 24 by the carbon dioxide method. Outage time is decreased, Jenkins noted. And both labor and material costs for inspection and overhaul are cut, he said, with safer working conditions.

The carbon dioxide method is still used to de-gas or fill turbogenerators, Jenkins continued, because the shaft oil seals do not permit pumping a

(*Continued on page* 214)

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING SEPTEMBER

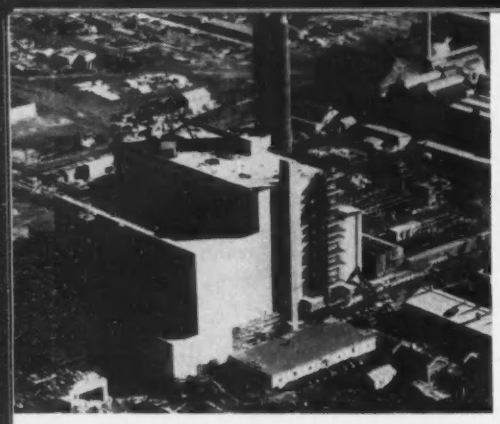
State	Utility	Plant	Fuel	Capacity
Conn.	Connecticut Light & Power	Thompsonville	S	5,000
N. Y.	Freeport Electric Department	Freeport	IC	3,100
Pa.	Pennsylvania Power & Light	Sunbury	S	125,000
Ohio	Cleveland Electric Illuminating	Eastlake	S	100,000
Ohio	Dayton Power & Light	O. H. Hutchings	S	60,000
Ill.	Marshall Utilities	Marshall	IC	1,243
Ill.	Red Bud Power, Light & Water Department	Red Bud	IC	1,000
Ill.	Commonwealth Edison	Dixon	S	60,000
Kan.	Ashland Water & Light Department	Ashland	IC	675
Md.	Consolidated Gas, Electric Light & Power	Riverside	S	75,000
Va.	Danville Water, Gas & Electric Department	Brantley	S	11,500
Va.	Corps of Engineers	J. H. Kerr	H	32,000
Va.	Corps of Engineers	Philpott	H	7,300
N. C.	Duke Power	Buch	S	125,000
Tenn.	Tennessee Valley Authority	Boone Dam	H	25,000
Okla.	Corp of Engineers	Fort Gibson	H	11,250
Wash.	Pacific Power & Light	Yale Project	H	108,000
Ore.	Portland General Electric	T. W. Sullivan	H	15,400
Calif.	Burbank Public Service Department	Burbank	S	30,000
Calif.	Pacific Gas & Electric	Contra Costa	S	112,500

PLANT RETIREMENTS DURING SEPTEMBER

Pa.	Pennsylvania State College	State College	S	1,250
Mich.	Consumers Power	Stronach	H	800
Mich.	Consumers Power	Shiaswasse	H	150
Mich.	Consumers Power	Baldwin	IC	330
S. D.	Wessington Springs Municipal Electric Dept.	Wessington Springs	IC	137
Kan.	Kansas Power & Light	Atchison	S	2,000
Va.	Virginia Electric & Power	Alexandria	S	5,000
Va.	Virginia Electric & Power	Hampton	S	6,500
Ky.	Tennessee Valley Authority	Hopkinsville	S	4,300

H—Hydro, IC—Internal Combustion, S—Steam

United States Capacity as of Oct. 1—Hydro, 21,498,505 kw; Internal Combustion, 2,136,182 kw; Steam, 63,961,601 kw; Total, 87,596,288 kw.



In power plants like Astoria . . .

Silicone Helps Solve Insulation Problems

Successful experience with silicone-glass insulation has been the basis for purchase of 106,175 hp of Class H insulated motors by Consolidated Edison Co of New York. These motors were rated from 200 to 2,500 hp for station auxiliary power drives. Initial purchases were made in 1945. Since then the slight average premium on Class H motors has been more than compensated by the increase in dependability so necessary in large power plants.

The new high-temperature insulation is also bringing maximum reliability to power plant design. Dry-type transformers with Class H insulation may be installed anywhere in the plant where suitable load areas exist. They do not require heavy vault construction and fire protection. Design of auxiliary supply systems is much simplified by their use.

JOHN G. NOEST, Assistant Inside Plant Engineer, Consolidated Edison Co, New York 3, N. Y.

Con Edison has 81 dry-type Class H insulated transformers with a total capacity of 97,800 kva operating in the auxiliary supply systems of its Hudson Avenue and East River Stations. The new Astoria Station also will have these transformers.

With silicone-glass insulation available in these two important equipment categories, reliability may prove less expensive than in the past. Duplication of equipment ensured reliability some 25 years ago. But it also made plants very expensive to build. Often the duplication went beyond the double-bus arrangement for the main buses and applied even to the auxiliary supply buses.

Today the unit principle of design has imposed a greater premium on improved reliability of all the main components of the plant and particularly on the essential auxiliaries. Duplication of equipment is now held to a minimum or avoided altogether.

Remaining equipment in the system carries added responsibility. In an effort to forecast reliabiltiy under given conditions, Con Edison engineers studied past equipment failures in their plants. Their reports disclosed that motors in particular are sensitive to the hazards of water, steam-leaks, dust, dirt, cinders. Here are some highlights:

Case of the Strong Northwest Wind . . . Early one freezing morning, a sudden load swing at a major Con Edison station blew off the safety valves of all the boilers for several minutes. A

BURNOUTS CEASED when this 350-hp Class A insulated salt-water pump motor was rewound with Class H insulation

UNIT SUBSTATION, which consists of a sealed dry-type Class H insulated transformer and the related switchgear, feeds a 2,000-hp forced-draft fan in plant

strong northwest wind drove the steam back into the upper portions of the boiler room where the forced-draft and induced-draft fans were located. There, the steam condensed on the relatively cold surfaces of the building and on the frames and windings of the motors.

Dense fog hampered efforts of the operators to shut off electrical equipment. The condensed steam caused:

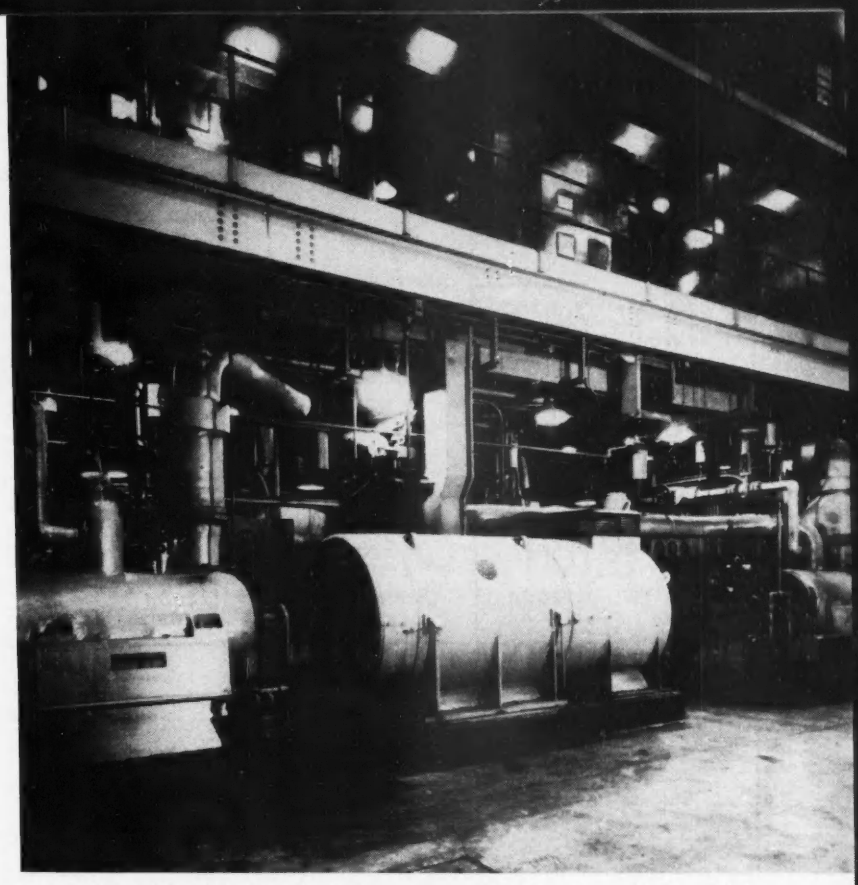
- Failure in stator windings of two 200-hp, 3-phase commutator-type motors.
- Internal flashover in four open, dry-type rotor circuit transformers used with the commutator motors.
- Flashover in the stator windings of one three-speed, 1,200/600/200-hp squirrel-cage induction motor.

All of these motors were open-frame drip-proof types. Insulation failures occurred because the winding insulation was prematurely and excessively aged by the normally high ambient temperature in the area. It was unable to withstand the extreme moisture condition. For several days the station suffered a capacity loss of 100 Mw.

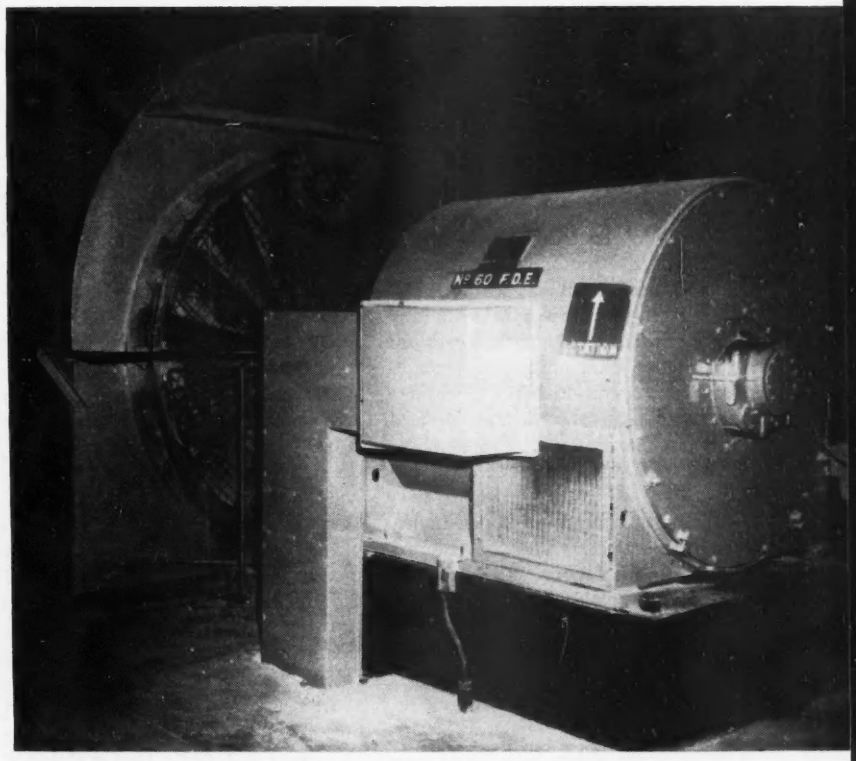
Case of the Sand-Blasting Cinders . . . During World War II one Con Edison station carried a particularly heavy load because it was connected with an aluminum reduction plant. With a high load on the boilers, flue-gas pressure rose above atmospheric pressure at the base of the stack, in the duct work, and in the housings of the induced draft fans.

At each of these points there was a large number of normally insignificant leaks. Under the higher pressure, each leak discharged cinders. Sand-blasting action of the cinder-contaminated air caused erosion of winding insulation and developed failures in the induced draft fan motors. During the several months that it took to locate and repair the leaks, six motors failed.

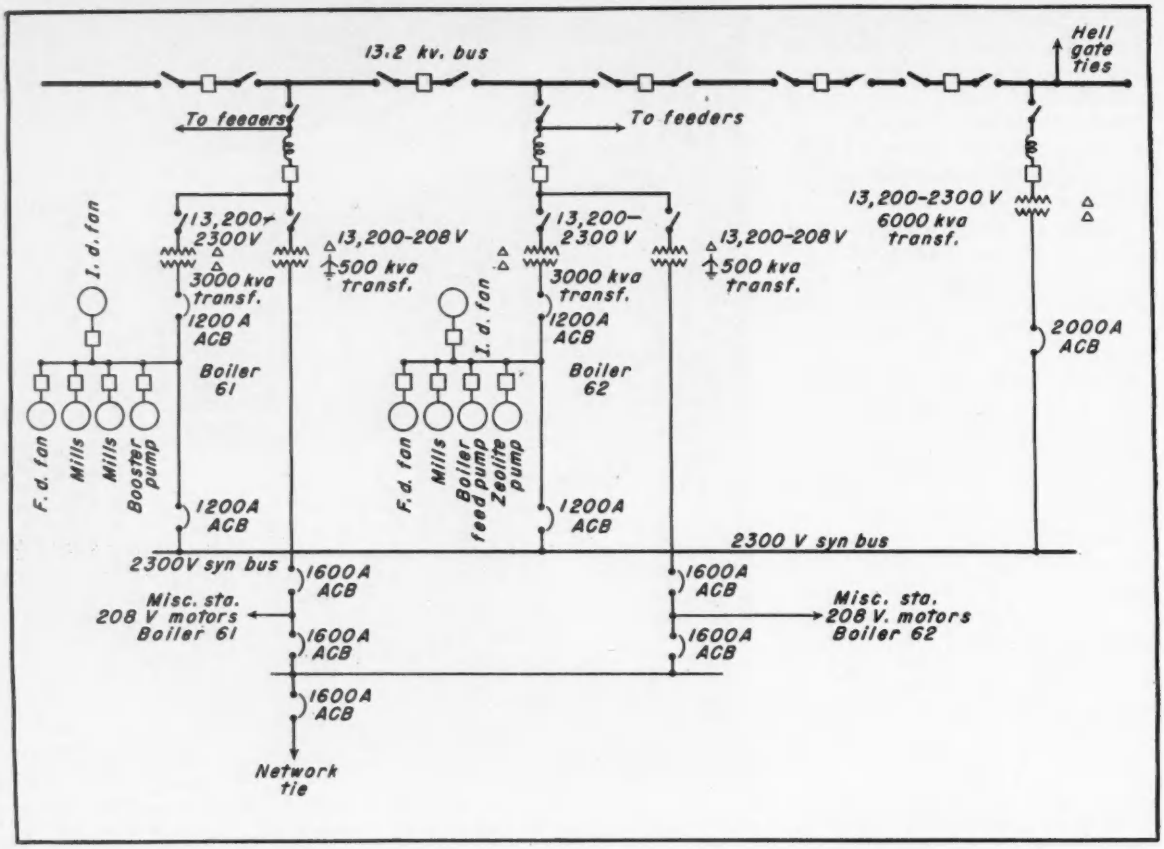
Case of the Steamy Boiler Room . . . Several boiler tube failures in another major Con Edison station always resulted in the loss of one of the major auxiliary drive motors such as forced or induced-draft fans. This station is designed on the unit principle without duplication of auxiliary equipment. When one motor fails on the single load feeder, all of the other equipment on the feeder is de-energized when it is tripped out. Loss in



CLASS H-INSULATED, 2,250-hp boiler feed pump motors in Hudson Avenue Station addition are located directly below the transformers on the balcony. The low voltage run is only 30 ft



EXPERIENCE with new silicone insulation at other plants led to its widespread use at new Astoria Station. This 1,000-hp motor driving a forced-draft fan was a pioneer installation



CONVENTIONAL METHOD used for many years to provide auxiliary power for a central electric generating station requires long cable and conduit runs. The oversized transformers and the switchgear must be centrally located and heavily protected to assure reliable service

each instance was held down to a single motor.

Insulation resistance measurements on all of the motors in the steam-exposed area were made within a half hour after the boiler tube failure. The insulation resistance had dropped to a value below minimum requirements for operation of:

- Four 600-hp forced and induced draft fan motors.
- Two 1,500-hp boiler-feed pump motors.

These motors were open-frame, drip-proof types with conventional Class A insulation. Failure was caused by a combination of high ambient temperature and the inability of the windings to resist moisture.

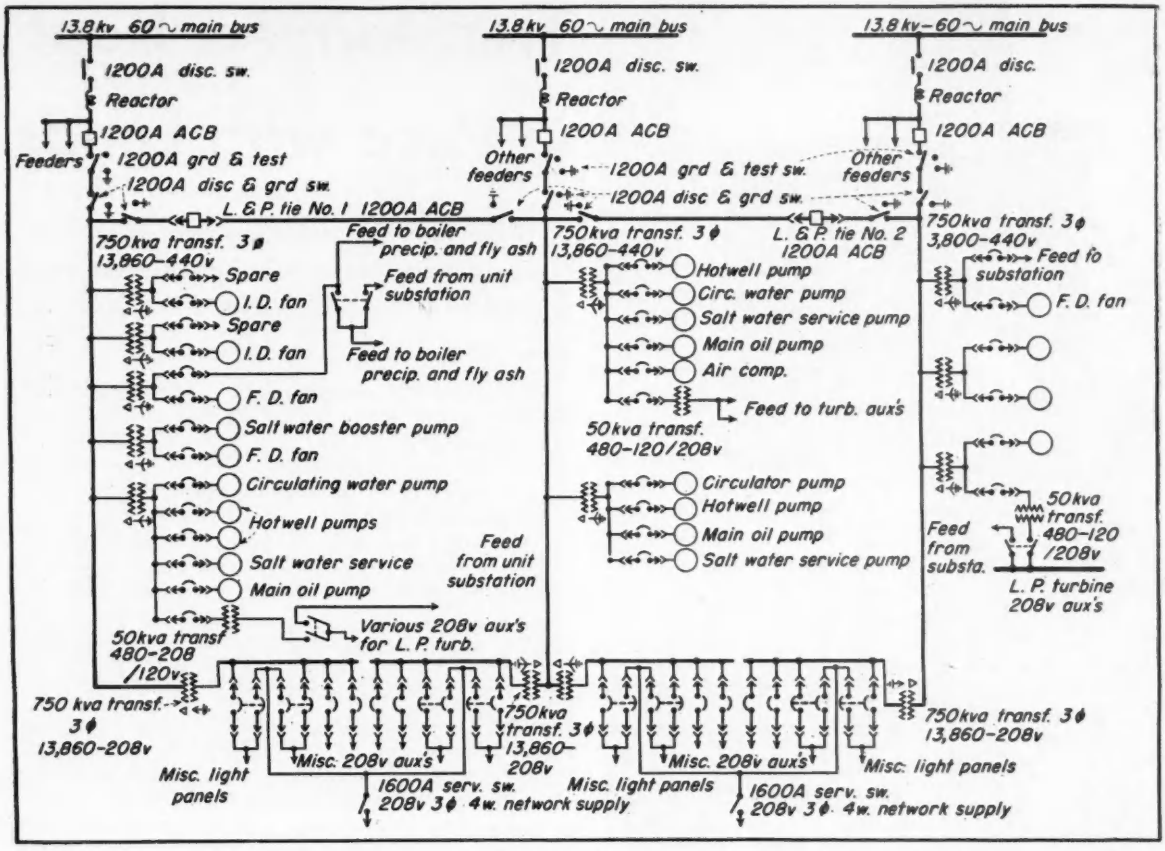
Silicone Offers Solution . . . Late in 1944 Con Edison engineers were shown a glass fabric tape which had been coated and impregnated with silicone resins. Not much of this new material was available for non-defense industrial use. But the little at hand was used to rewind several motors in order to gain some operating experience with the new insulation.

Of the newly rewound group of motors there had been two particularly annoying cases of repeated winding failures. One involved a 2,300-v totally enclosed motor. It was rated 350 hp but was driving a salt-water pump which loaded it to 410 hp. For flood protection a tub-like enclosure was used to surround the motor. But the tub also recirculated the cooling air, causing the motor to run hot. With Class A insulation, failure occurred on an average of twice a year.

Then the motor was rewound with the new silicone impregnated insulation using fiber-glass on the conductors, fiber-glass backed mica as slot insulation, and fiber-glass tape as the outer covering. The motor runs as hot as ever in the same surroundings. But there have been no further failures.

In the second of these cases, a group of 800-hp boiler-feed pump motors were located in a pocket of a plant basement. Not only was ambient temperature very high, but the motors were overloaded by about 15%. Failures were frequent until these motors were rewound with the new class H insulation.

Silicone Insulation in Dry-Type Transformers . . . A new departure in auxiliary supply systems is now possible with dry-type, sealed-tank transformers in which the cooling medium is inert air or nitrogen gas. They are intended for unit substations which are served directly by the high-voltage load feeder.



NEW METHOD of providing auxiliary power in generating stations is made possible by the installation of dry-type Class H insulated transformers. The high-voltage feeder runs directly to a number of load center unit substations. Each of these serves the nearby area

Each load center unit substation transformer is located close to the load so that low-voltage connections are very short. Costs are reduced in this type of system by elimination of vaults, drains, mains, traps, and fire protection, even though the initial costs of the transformers average about 25% above conventional oil-filled units. Although such transformers are available with Class B insulation, Class H offers a greater guarantee of maximum insulation life and reasonable overload capacity.

Cable Connection Still a Problem . . . With the use of Class H insulation in motors and transformers, and with enclosed switchgear, there is still no satisfactory solution for cable connections to such equipment:

- Windings on a Class H insulated motor may operate at 140 C. The terminal box attached to the motor may well rise to 100 C; yet cable connections must often be made within this box.
- Dry-type transformers may require cable connections to the high and low-voltage sides. The point to which the connections must be made operates at temperatures of over 100 C.
- Enclosed switchgear connection points for cable may operate at 85 C.

How can available cable, which has a maximum permissible copper temperature of 85 C under load, be connected to the Class H insulated motor or transformer, or to enclosed switch gear?

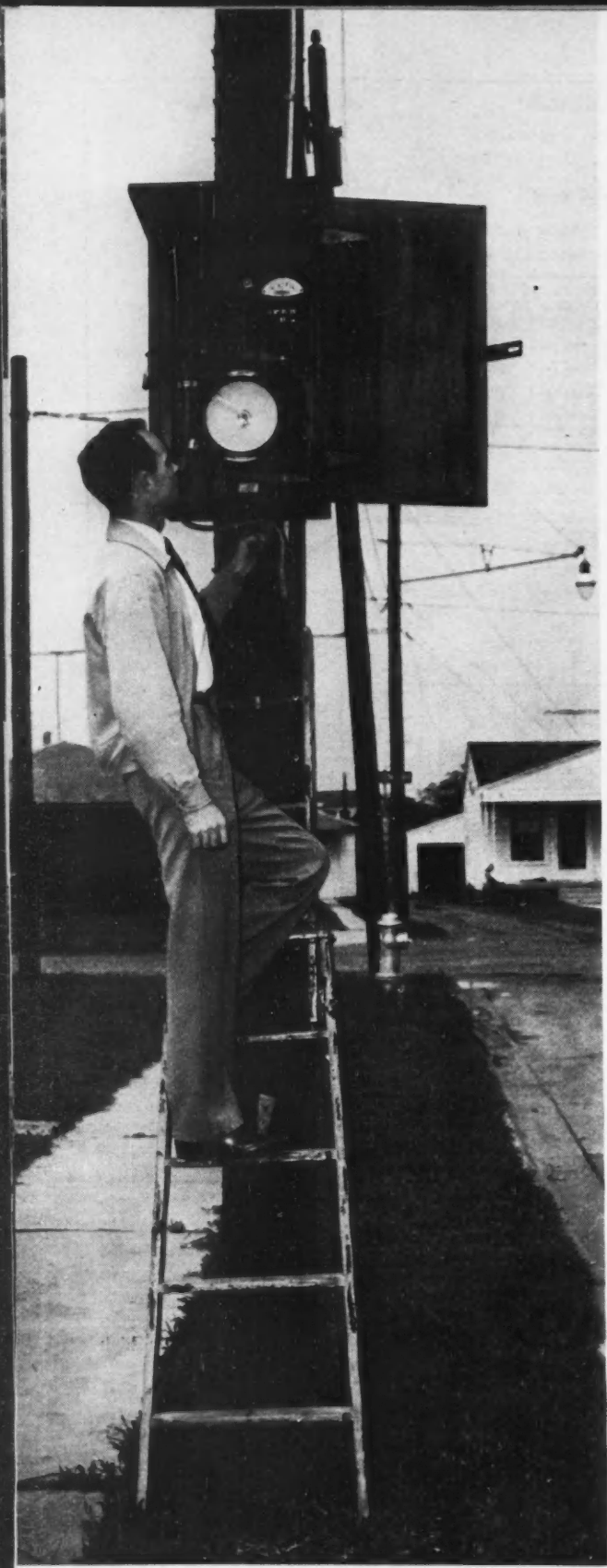
There are make-shift solutions to these problems. On the transformers and switchgear, copper connections are provided for a sufficient distance to get out of the high ambient temperature. For motors the regular cable insulation is removed and replaced by hand-applied Class H insulation over a distance great enough to get out of the high temerature zone.

The real solution lies in the development of cable insulation capable of operating in the required higher temperatures. Its cost should be reasonably competitive with existing cable. If such a cable were available today, it would find particular application in general cable runs within power plants. Existing cables are now severely derated because of the relatively high ambient temperatures.

In addition to these major problems involving electrical insulation in power plants, there are a considerable number of minor ones which remain to be solved. There is a need for complete Class H insulation for small motors with random wound windings and complete Class H insulation for solenoids as used in magnetic contractors, valves, actuators, and similar devices.

Transformers Kept in Pace with Loads

Peak load season testing supplies data for replacement program which has reduced interruptions on Dallas P&L system nearly 70%



EQUIPMENT (current and potential transformers and watthour and recording demand meters) make transformer load estimating accurate

Faced with the constant problem of operating between the limits of too many interruptions on one hand and too much cost on the other, Dallas Power & Light Co's distribution department has evolved a method of estimating transformer loads based on continuous spot tests.

On the Dallas system a banked-transformer scheme is used. In general transformers on the 4-kv system are of the conventional type, and those on the 13-kv system are of the CSP type.

Secondary buses are fed by not more than three transformers. Failure of one transformer on a bus, or tripping of one secondary breaker, sometimes results in loss of the entire bus, through failure of the fuses on the other transformers or tripping of the other breakers. Peaks on this system occur in summer

Soon after the war, following the rapid load growth of that period when transformers were hard to get, failures of conventional transformers and breaker openings on CSP's reached an alarming rate.

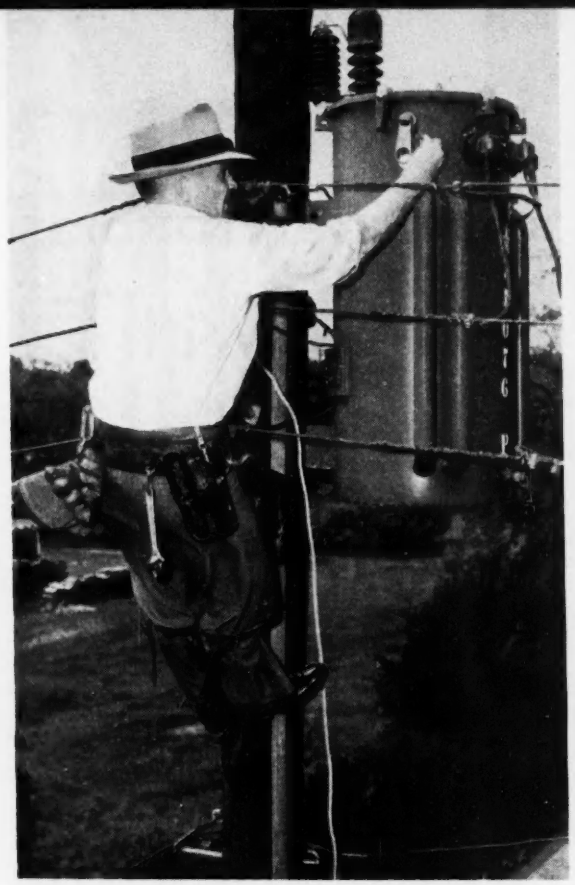
Establish Two-Part Program . . . To reduce the number of interruptions to a more reasonable figure a two-part program was developed.

1. A load survey was planned to take some of the guess work out of transformer load estimates. Replacement of transformers that were too heavily overloaded, or would be too heavily overloaded before the next peak load season, was to be carried out during the winter months.

2. Most of the transformers on the 13-kv system are of the CSP type. To catch close cases of overload, during the summer peak load season, before breakers tripped, a system of night patrols was established. Red overload lights were noted, and transformers were replaced during the day as soon as crews could get to them. These patrols covered the complete system every two weeks.

Load Surveys . . . Demand meters were installed on several selected primary taps having from one to six secondary buses. Installations were made on taps that were considered typical of a class of residential load area. Tests were conducted during the system peak period of June through September. They showed average load per customer to range from ¾ to 5 kva.

Field checks were made to determine the number of assigned to the nearest transformer, and those from a pole from which services were taken. Customers on a bus were assigned to the nearest transformer, and those from a pole equidistant from two transformers were divided between the two. This information was posted on secondary bus and pole maps, and the record has been kept up to date.



WHEN TROUBLE DEVELOPS on a bus with CSP transformers installed, emergency overload lever is set up to carry the load that prevails

TRANSFORMER TRAILERS provide added capacity to restore service when secondary breakers trip repeatedly or transformers overload

Customer additions and subtractions were recorded daily. Transformer loads were estimated from the kva demand per customer figures determined by the tests for the type of load area and number of customers to the transformer.

Based on these load estimates a transformer replacement program was launched. In rapid load growth areas the transformer was replaced if the estimated load was 100% of rated capacity. In areas where growth was not so fast replacement was made when the estimated load reached about 140% of capacity.

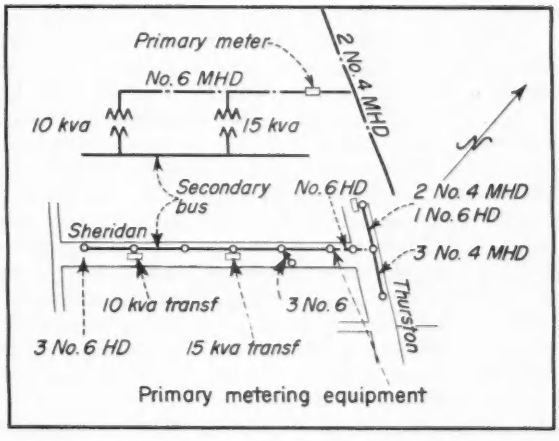
In order to be prepared for the peak season when it arrived, a continuous program of replacements was carried out. The result of this program has been a very substantial reduction in bus outages. In 1947 the total reached 470. In 1952 the bus outages numbered only 144, a reduction of about 70%, although the number of buses in operation had increased by nearly 4,500.

Kilowatt Hour Basis . . . Transformer replacements for the winter of 1953-54 will be based on service count on transformers with demands estimated at:

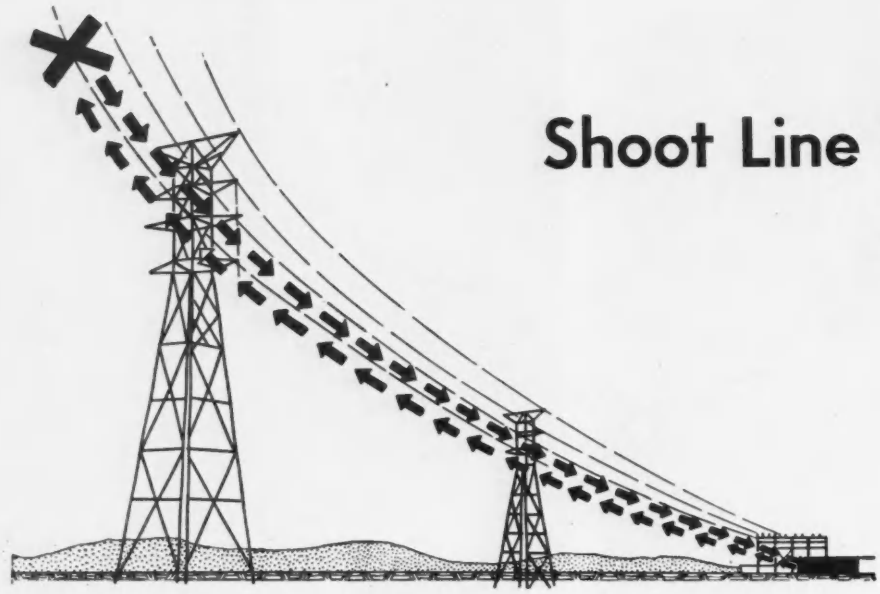
¾ kva per customer in light load areas
1½ kva per customer in medium load areas
3 kva per customer in high load areas

These figures were arrived at by test results and are adjusted on a basis of judgment and knowledge of the territory so that in specific cases demand per customer figures may be 1 kva, 2 kva or 5 kva.

Plans are being made to use IBM equipment for estimating transformer loads from the kilowatt hours used during the peak load billing period by customers served from the transformer. Primary metering test installations will be maintained, and load tests will be made on selected groups of transformers as a check on figures determined from kilowatt hour readings. This plan is expected to give a better estimate of the load on individual transformers than the present method.



MAXIMUM on a secondary bus is three transformers. Primary metering points are selected to represent different types of load areas



TEST SET IMPOSES dc impulse on faulted line and measures time required to reach fault X and be reflected back to test set. Set translates time into distance

Shoot Line Troubles With . . .

Special test set developed by the Utilities Research Commission locates trouble on overhead and underground transmission and distribution lines and on telephone and control cables. Makes fault location in field much easier

J. L. WHYSONG, Engineer, System Planning Department

H. L. GARTON, Engineer, Electronic Instrumentation and Control, Testing Department

J. F. BRACKEN, Section Engineer, Engineering Department

Commonwealth Edison Co, Chicago, Ill.

Radar principles have been adapted to trouble shooting on both overhead and underground circuits as well as multi-conductor control and communication cables on the Commonwealth Edison system.

The test equipment imposes a dc pulse on the faulted circuit, measures the time required for the pulse to reach the fault and reflect to the test equipment, thus indicating distance to the fault. Distance is read directly from a mechanical counter rather than from a calibration on the cathode ray tube. This differs from conventional radar which uses a radio frequency pulse through space.

As the dc is confined to the line, much less power is required than for conventional radar. Use of the dc pulse eliminates all radio frequency components such as the magnetron and high frequency plumbing found in the conventional radar set. The receiver becomes a relatively simple broadband amplifier as no RF oscillators, amplifiers, or mixers are required.

The radar fault locator is usually connected from conductor to ground but may be connected between conductors. On overhead lines reflections are quite sharp; however, attenuation on underground circuits reduces sharpness of the signal and ranging is more difficult.

Type of fault can be determined from polarity of reflected pulse. An open circuit will reflect a pulse of the same polarity as the transmitted pulse. A short circuit will reflect a pulse of the opposite polarity.

For best results the set must be calibrated on each line tested. The easiest way to calibrate the set is to adjust it to give the correct range reading to the end of the line, using a good phase. Under extreme conditions, when a good phase is not available, other methods must be used, but this is rarely necessary.

Overhead Lines . . . The fault locator is most readily used on overhead lines for several reasons:

1. High characteristic impedance of the overhead line makes it possible to detect high impedance ground faults. Also, with broken or twisted conductors the change from normal impedance is great, and an easily identifiable reflection is provided.

2. Reflections are sharp, and therefore ranging accuracy is good.

3. If all three conductors are burned or broken, a known impedance discontinuity may be used for calibration purposes; or a lineman may ground one conductor at any convenient location.

Results with overhead line faults have been good. Usually the radar test will come within one or two spans of determining the correct location of the fault.

Locating faults on lines with taps is more difficult, but it can be accom-

RADAR

RADAR TEST SET is operated by J. L. Whysong, left, in substation where it is set up and connected to faulted circuit to determine location of trouble

plished if there are no more than two and possibly three taps.

The locator has been tried on energized overhead lines by connection through a carrier coupling capacitor. For this type of operation a narrow band rejection type filter is used to keep carrier signals from appearing on the test set oscilloscope. As the transmitted pulse is not a radio frequency burst but merely a straight dc pulse, the carrier capacitor differentiates the transmitted and reflected signals. The reason for this is that the time constant of the coupling capacitor and line impedance is substantially less than the duration of the transmitted pulse. Development work on "hot line" fault locators is continuing.

Use on Power Cables . . . Use of the fault locator on power cables is more difficult because:

1. Ratio of fault resistances to surge impedance of cable is usually rather high. Surge impedances range from 15 to 50 ohms and fault resistances from 200 to 400 ohms.

2. Reflected pulse does not have the sharp leading edge of the original transmitted pulse. This makes accurate ranging difficult, especially on the longer cables.

3. Each change in cable size or type may produce a reflection. The multiplicity of indications confuses the presentation on the oscilloscope and makes it more difficult to pick out the fault reflection.

The radar fault locator has been very successful in locating faults in underground cables when one or more conductors are burned open. However, the locator is not successful on grounded conductors that have not burned open because the fault resistance is nearly always above the surge impedance, as explained above. Reliable accuracy of measurement is usually 100 to 150 ft. This is normally good enough to locate the trouble between any two manholes.

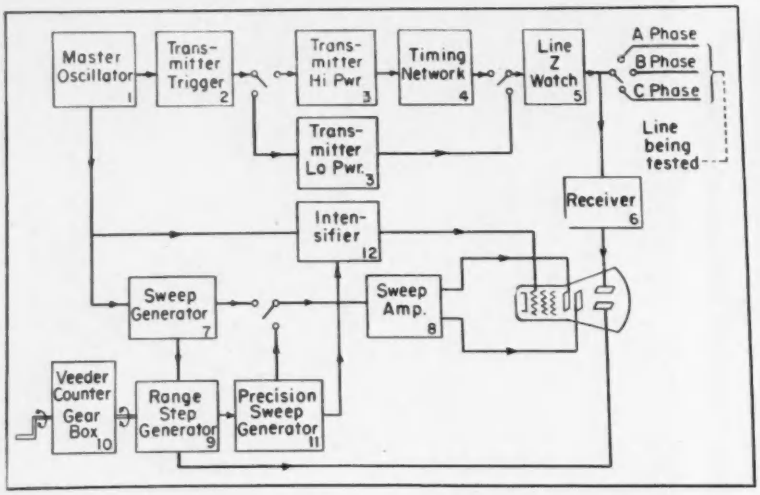
For buried cables that are burned open or have low fault resistance the fault locator may be used to localize the fault within a 100 to 150 ft segment. An impulse tester may then be used, and that segment may be minutely patrolled with a detector to find the fault.

Use on Communication Cables . . . Tracer methods of fault location cannot be used on multi-conductor telephone-type cables with paper insulation because of the low breakdown characteristic of the paper insulation. The radar fault locator has been highly useful on such cables, performing better than on power cables because of the relatively high surge impedance of a conductor in the communication cable. As a result, the impedance of a fault can be quite high and still be detectable. Very good results have been obtained on all types of faults on communications cables (Table).

Following successful field experi-

REFLECTED PIP on 12-kv underground cable lacks sharpness of overhead line pip

OPEN FAULT on overhead 33-kv line gives sharp pip on the oscilloscope



PRINCIPAL PARTS and the arrangement of the special radar test set being used by Commonwealth Edison to locate faults are shown on diagram. The 12 major circuits are indicated

ence with the initial radar fault locator, improvements in the equipment have been made.

General Circuit Descriptions . . . The block diagram of the radar fault locator indicates the general circuit arrangement of the set. Wiring diagram is also shown.

There are 12 major circuit elements in the test set:

1. Master oscillator which provides trigger pulses to control the firing of transmitter and start of sweep circuits.

2. Transmitter trigger amplifier to delay the pulse for a few microseconds, until the sweep circuits function.

3. High power transmitter consisting of hydrogen thyratron which discharges a timing network into the line being tested. Low power transmitter may also be triggered to provide a pulse of less than 0.5 microsecond duration.

4. The three timing networks, designed to match impedances of overhead transmission lines, underground power cables, and telephone pairs.

5. The line impedance matching unit also includes a condenser to isolate the test set from ground currents and a phase selector switch to facilitate connecting the set to any of the three phase conductors of the power line.

6. The receiver is a three-stage, high-gain, broad band amplifier. For close-in faults, if normal transmitter power were used, the receiver might still be saturated when the echo from the fault is received. This difficulty may be avoided to a great extent by using the low power transmitter. The short pulse length makes it possible to measure faults which are only a few hundred feet from the set.

7. The sweep-generator, which is controlled from the master oscillator, provides a sweep voltage to the sweep amplifier.

8. The sweep amplifier is a combination amplifier and phase inverter. It provides push-pull output to the horizontal deflecting plates. A dc restorer provides horizontal centering and insures accurate retracing of successive sweeps.

9. The sweep-generator output is also used to trigger the range step generator.

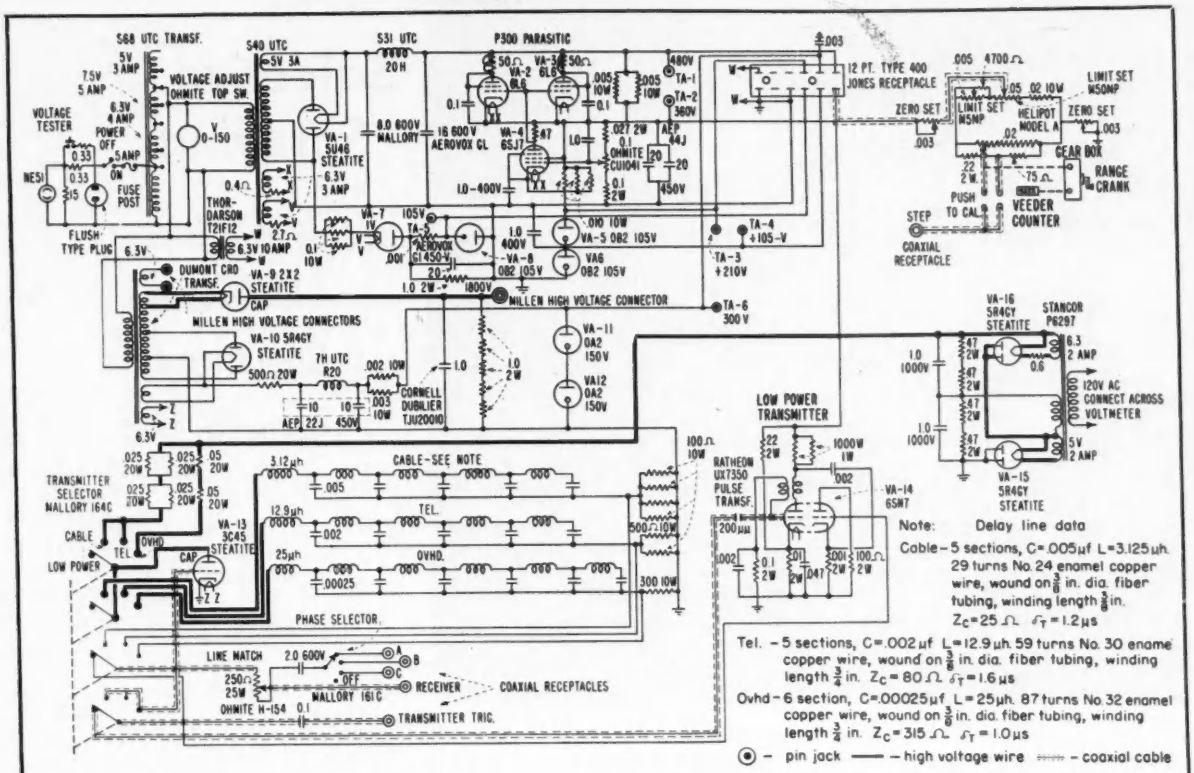
10. The range unit consists essentially of a voltage divider potentiometer whose voltage range can be adjusted by means of variable resistances connected in series to each end of the potentiometer. The setting of the range potentiometer is done by a crank on the front panel. This crank is coupled to the potentiometer through a gear box equipped with a mechanical counter.

11. The precision sweep generator, triggered from the range step generator, provides a high-speed sweep that starts at the range step and extends for about 3,000 ft.

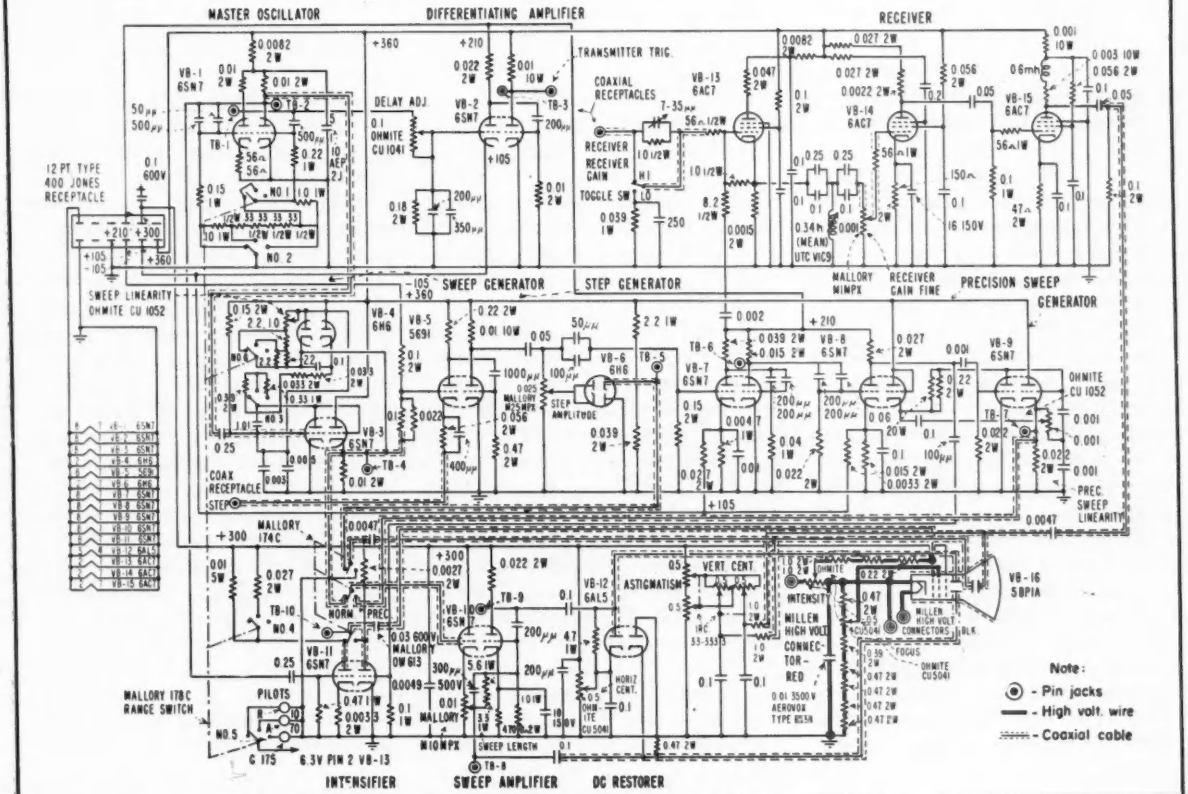
12. An intensifier circuit which can be triggered from either the normal or precision sweep effectively suppresses the fly-back sweep.

Performance Record of Radar Fault Locator on Chicago System

Type of Cable or Line	Entire Length in Feet	Radar Distance to Fault in Feet	Circuit Conditions	Results
3-phase/9-kv Power cable	15,471	13,340	One phase open, two phases unfaulted	Correctly located fault between manholes
Supervisory control cable-16 pair	6,015	5,279	One conductor open, other wires normal	Correctly located fault between manholes
3-phase/12-kv Power cable	5,470	4,710	Two phases open, one phase unfaulted	Correctly located fault between manholes
3-phase/20-kv Power cable	50,993	23,130	One phase grounded, two phases unfaulted	Measured distance to within 7 ft of actual fault
3-phase/9-kv Power cable	23,830	13,520	One phase open, two phases unfaulted	Correctly located fault between manholes
3-phase/33-kv Buried cable	6,520	3,230	Buried cable 42 in. below surface. No manholes. One phase open, two phases unfaulted	Radar located fault within 100 ft. Used 40-kv thumper to identify exact location
3-phase/33-kv Overhead line	45,936	21,965	One phase grounded, two phases unfaulted	Radar located trouble within one tower span
3-phase/33-kv Overhead line	69,960	49,200	One phase open, two phases unfaulted	Radar located trouble within one tower span
Reel of supervisory cable	450	245	One wire open, others unfaulted	Radar located open conductor within 3 ft of break
4-Cond. pilot wire for control	40,591	31,780	Variable high resistance in one conductor	Correctly located fault between manholes
Supervisory control cable—16 pair	9,097	2,650	All conductors grounded 75 ohms to ground	Correctly located fault between manholes


S68 UTC TRANSF.
S40 UTC
S31 UTC
P300 PARASITIC
VOLTAGE ADJUST OHMITE TOP SW.
VOLTAGE TESTER
POWER OFF ON
FUSE POST
THOR-DARSON T21F12
FLUSH TYPE PLUG
DUMONT CRO TRANSF.
MILLEN HIGH VOLTAGE CONNECTORS
MILLEN HIGH VOLTAGE CONNECTOR
12 PT. TYPE 400 JONES RECEPTACLE
ZERO SET
LIMIT SET
HELIPOT MODEL A
GEAR BOX
RANGE CRANK
PUSH TO CAL
VEEDER COUNTER
COAXIAL RECEPTACLE
STANCOR P6297
120V AC CONNECT ACROSS VOLTMETER
LOW POWER TRANSMITTER
RATHEON UX7350 PULSE TRANSF.
TRANSMITTER SELECTOR MALLORY 164C
CABLE
LOW POWER
TEL.
OVHD.
CAP
CABLE-SEE NOTE
PHASE SELECTOR
LINE MATCH
OHMITE H-154
MALLORY 161C
RECEIVER
TRANSMITTER TRIG.
COAXIAL RECEPTACLES
Note: Delay line data
Cable – 5 sections, C=.005μf L=3.125μh. 29 turns No. 24 enamel copper wire, wound on 3/8 in. dia. fiber tubing, winding length 3/8 in. Zc=25Ω δT=1.2μs
Tel. – 5 sections, C=.002μf L=12.9μh. 59 turns No. 30 enamel copper wire, wound on 3/8 in. dia. fiber tubing, winding length 3/4 in. Zc=80Ω δT=1.6μs
Ovhd – 6 section, C=.00025μf L=25μh. 87 turns No. 32 enamel copper wire, wound on 3/8 in. dia. fiber tubing, winding length 3/4 in. Zc=315Ω δT=1.0μs
⊙ – pin jack —— – high voltage wire ····· – coaxial cable

IMPEDANCE MATCHING CIRCUITS adapt the fault locator to various types and lengths of circuits. There are 12 major circuit elements: 1 Master oscillator, 2 Transmitter trigger amplifier, 3 Two transmitters, 4 Three timing networks, 5 Line impedance matching units, 6 Receiver, 7 Sweep generator, 8 Sweep amplifier, 9 Range step generator, 10 Range unit, 11 Precision sweep generator, and 12 Intensifier



Selective Spraying

. . . at the base eliminates unwanted growth, but . . .

Basal Spraying Extends Season

L. L. COULTER and K. C. BARRONS,
Biochemical Field Research, Dow Chemical Co., Midland, Mich.

Control of woody plants by application of basal sprays has many operational advantages over the more conventional foliage spraying.

- It requires less expensive equipment.
- Season for effective application is longer.
- Light equipment encourages use in areas inaccessible to spray trucks.
- Winter spraying minimizes risk of drift damage to sensitive annual crops.
- Dormant season control avoids complaints of unsightliness in resort and vacation areas.
- Year around employment aids development of well-trained crews.

Basal spraying was reported as early as 1947. Several chemical companies and state and federal experiment stations have devoted considerable research to developing methods of woody plant control by basal spraying, frill application, and stump treatment. There is now adequate experience with these methods to permit evaluation as tools in right-of-way brush control.

Properly applied, basal sprays may be expected to give excellent top kill of the more resistant plants. But they may give no greater root kill than foliage applications on many species. Exceptions are certain maples which are very susceptible to basal spraying with 2, 4, 5-T in oil. These may be expected to show good root kill from this treatment. Oak and ash also respond. And most species show excellent top kill with a significant reduction in resprouting.

Sod or shrubs provide good cover . . . Sod has usually been considered a desirable vegetative cover for rights-of-way, but shrubs also retard re-invasion with tree species under some conditions. Selective basal application only to potentially tall-growing woody plants has been proposed as a method of preserving desirable low-growing shrubs. Drift of spray to desirable woody plants, such as grapes, must always be avoided.

Troublesome invasion of sod with woody species would no doubt vary with soil, climate, and the woody plants present in the surrounding area. But observations indicate that reinvasion is usually slow where thick turf develops as competitive woody plants are eliminated. Reinvasion with shrub and tree species may occur more readily in poor acid soils where grass has difficulty becoming established.

Certain low shrubs may be beneficial to some forms of wildlife. This subject will require further study. Obviously it will vary with the wildlife species and the nature of the surrounding habitat.

Utility engineers will have to decide for themselves, after experimental comparisons, whether conversion to a sod cover or to a part sod and part

Foliage Spraying

. . . requires less skill

for Chemical Brush Control

shrub cover is a desirable objective for their rights-of-way. In addition to these various aspects of long range vegetation control, the engineer must also consider the condition of the rights-of-way most desirable from the standpoint of line maintenance.

First field work in the development of 2,4-D and 2,4,5-T as herbicides for woody plant control involved application in water as foliage sprays. Early experimenters applied these herbicides for right-of-way control with existing equipment developed for the application of insecticides and fungicides. Foliage application using water as the carrier probably accounts for close to 90% of the brush being treated.

Foliage spraying has advantages . . . The popularity of the high-volume foliage spray may be attributed to several factors:

- The technique permits rapid and full coverage of large areas.
- Dense brush may be treated readily by this method.
- It is not a precision operation and permits use of relatively unskilled labor under proper supervision.

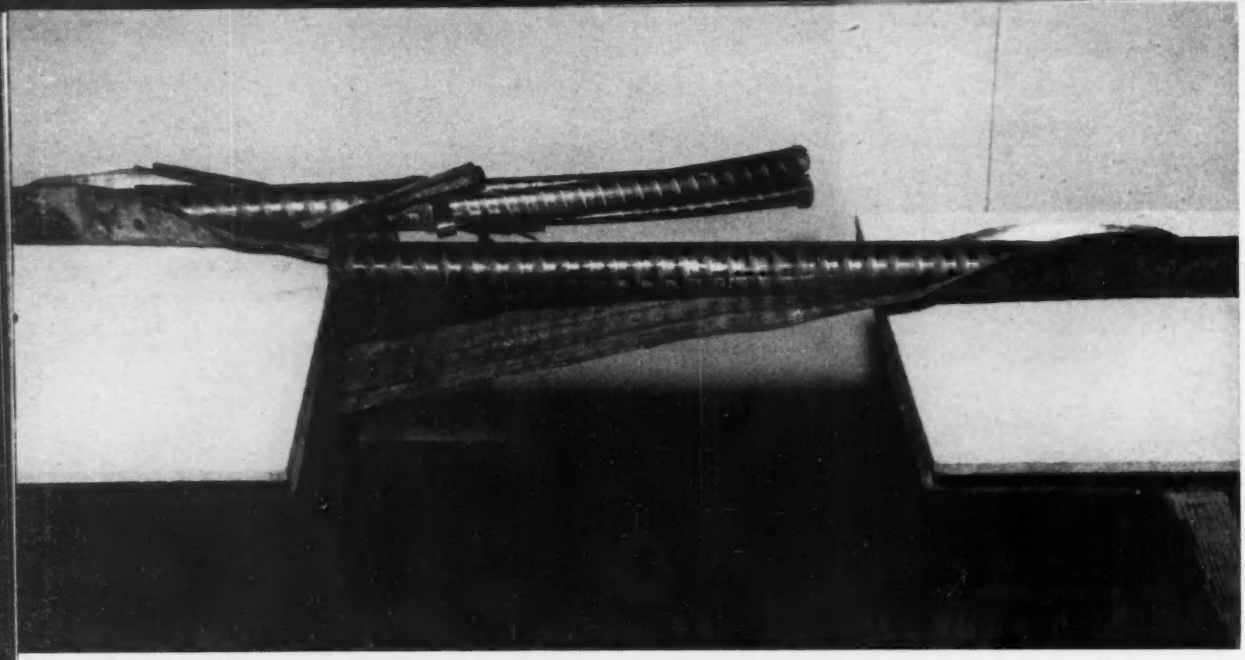
Foliage sprays are often referred to as blanket sprays. But this term is misleading because they can be applied in such manner as to preserve low growing shrubs, ferns, and various herbaceous plants.

High-volume foliage spraying may result in some injury to plants off the right-of-way if drift is permitted. This method has the advantage, however, of involving a low concentration of toxicant compared with the high concentrations used in oil for basal spraying. Foliage treatments may be applied using low pressures and coarse droplets, and proper procedures hold drift to a minimum.

But high volume foliage spraying requires hauling a considerable amount of water. This may be a problem where access is difficult. The season of operation is limited to the summer months. Hardwoods such as maple, oak, and ash are sometimes tolerant to foliage sprays regardless of the chemical used. Root kill or even top kill of a high percentage of such stems is not always obtained.

Basal spray is good follow up . . . Many utilities use both methods. High volume foliage applications are used to convert populated rights-of-way economically and with maximum speed. Basal sprays are then utilized in follow-up treatment to control species which, for various reasons, are not killed by the first foliage spray. Periodic maintenance can then be carried out by basal treatment. This program appears to make the most efficient use of available techniques and does not restrict operations entirely to growing seasons.

The introduction of 2,4-D, 2,4,5-T, and ammonium sulfamate have given the utility engineer new techniques for combatting brush. And two important methods have been devised for their application. No longer need he depend upon the axe and brush hook. Many biological, engineering, and economic factors enter determination of the best method.



1 OVERLAP CABLES about 4 ft. Split and bend sheath away. Coil back and secure shielding tape and fillers. Cut back paper 5 in.

How to Duct-Splice Insulated Lead-Covered Cable

Ability to duct-splice cable into required lengths has paid off in meeting emergencies and sudden demands for power and emergencies. Procedure is shown for splicing compact-sector, three-conductor, 15-kv cable

J. B. BOWEN, Superintendent, Electrical Maintenance Division, San Diego Gas & Electric Co, California

Knowing how to duct splice paper-insulated, lead-covered cable may spell success or failure in meeting unforeseen power demands or an emergency condition. That is why, cable splicers of San Diego Gas & Electric Co all are trained and maintain their proficiency in the art of making this type of splice.

Ability to make duct splices proved beneficial to the company in several instances prior to and since World War II. In the first instance, San Diego G&E was faced with serving a military installation when lead cable was difficult to obtain. Several short pieces of cable were spliced and a satisfactory installation was made on the time required. This cable has remained in service without any indication of improper operation.

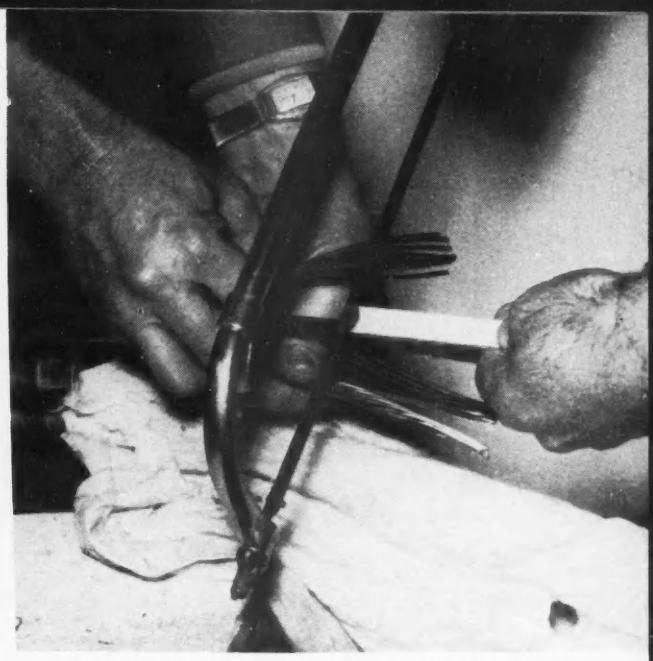
A recent harbor department development in San Diego called for 6,000 ft of three-phase primary underground cable. Known and assumed loads at time of construction indicated that No. 2 cables would serve the area. However, cable and wire deliveries were set at six months after required date of service. By using 50 pieces of three-conductor, 4/0 cable and making 24 splices, enough cable was repared to install the 6,000-ft run with service ready one week ahead of schedule. This installation has proved most fortunate in that present load requirements of the development now exceed the capacity of No. 2 cable.

Good Tensile Strength Vital . . . Duct splicing differs from conventional splicing mainly in that good tensile strength is the desired goal. Thus, a complete length of cable duct-spliced from several pieces will have sufficient strength so that conductors and not the sheath take the stress in pulling. Cables joined by duct splicing have withstood up to 90% of breaking stress of unspliced cables.

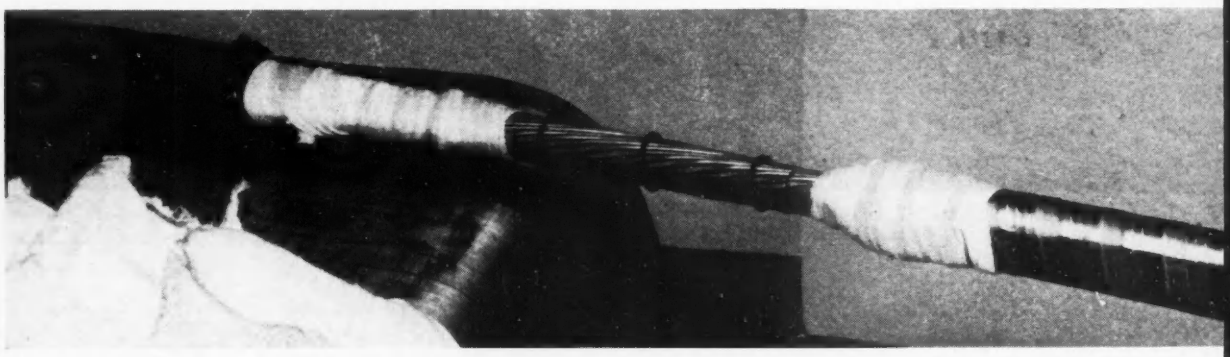
Procedure followed in making a duct splice is shown in accompanying illustrations. Used in this example is a 500,000 cir mil, compact-section, three-conductor, 15-kv cable. However, company crews have made satisfactory splices on a number of types, including an installation involving three-conductor, paper-insulated, lead-covered 4-kv cables where two No. 6 pieces and one 1/0 piece were joined to a section of 4/0.

(*Continued on page* 126)

2 MALE END is bound with wire and outer strands cut half way through bent back and snapped off. Make cut 3 in. from end



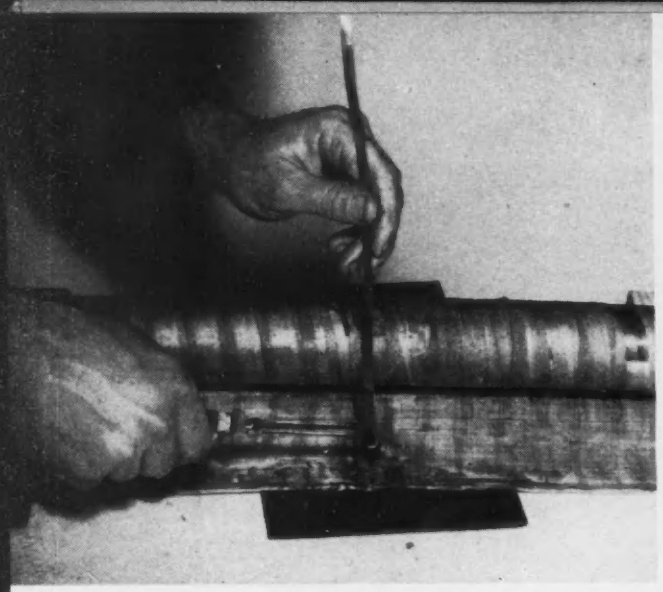
3 FEMALE END has outer strand layer spread and held until inner strands are cut. If bent too far strands resist return to original lay



4 JOINING ENDS is done after removing particles of copper. Connection is bound with wire and insulation taped to prevent heat damage

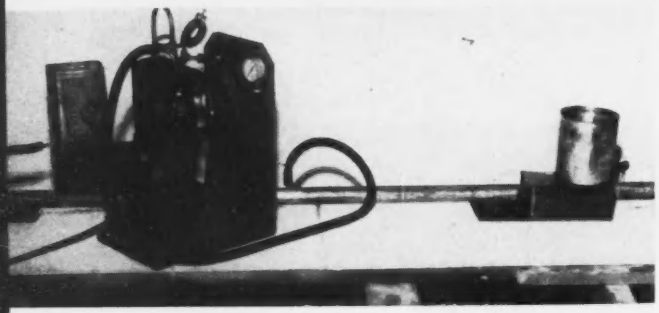
5 CONNECTION IS SWEATED. After wiping off excess solder, joint is cooled and filed. Surface is smoothed with emery cloth

6 SATURATED CREPE PAPER is easier to apply than cambric; dielectric properties appear equal. Shielding tape is replaced



7 LEAD BURNING is done after fillers are replaced. Lead sheath is repositioned, seam is burned from inside, then outside (bottom)

8 LONGITUDINAL SEAM is beat shut and lead burned. Duct splice made by two experienced splicers in 8-12 hr; learning takes 24



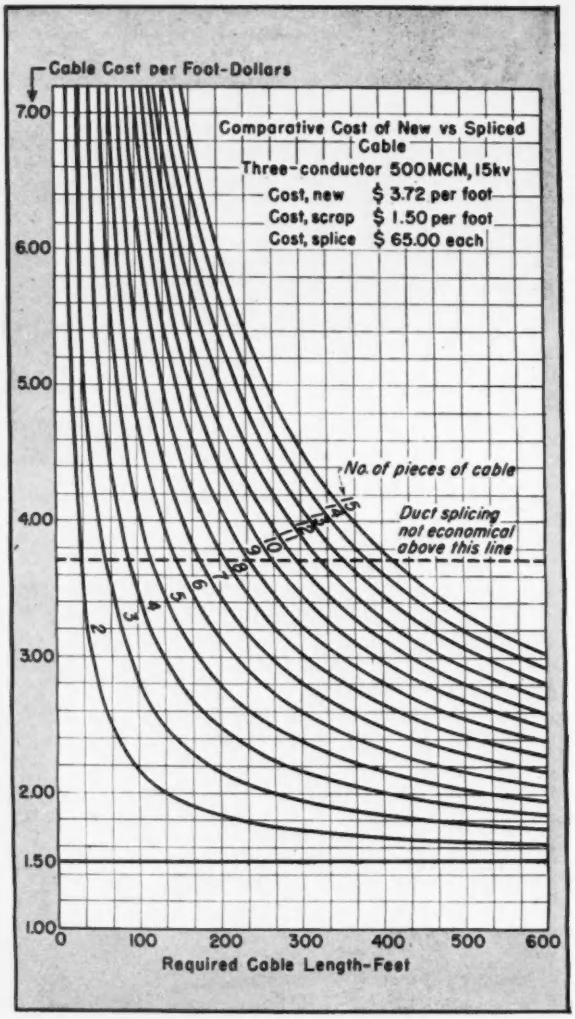
9 VACUUM TREATMENT for several hours removes air, forces oil into joint. Duct spliced cable has less life than new one

Taught on the Job . . . Use of lead-burned splices is only an emergency measure. Therefore, class or group instructions are not warranted. When such a splice has to be made, a less-experienced cable splicer works with an experienced splicer to learn the technique. Proficiency is gained only through repeated application.

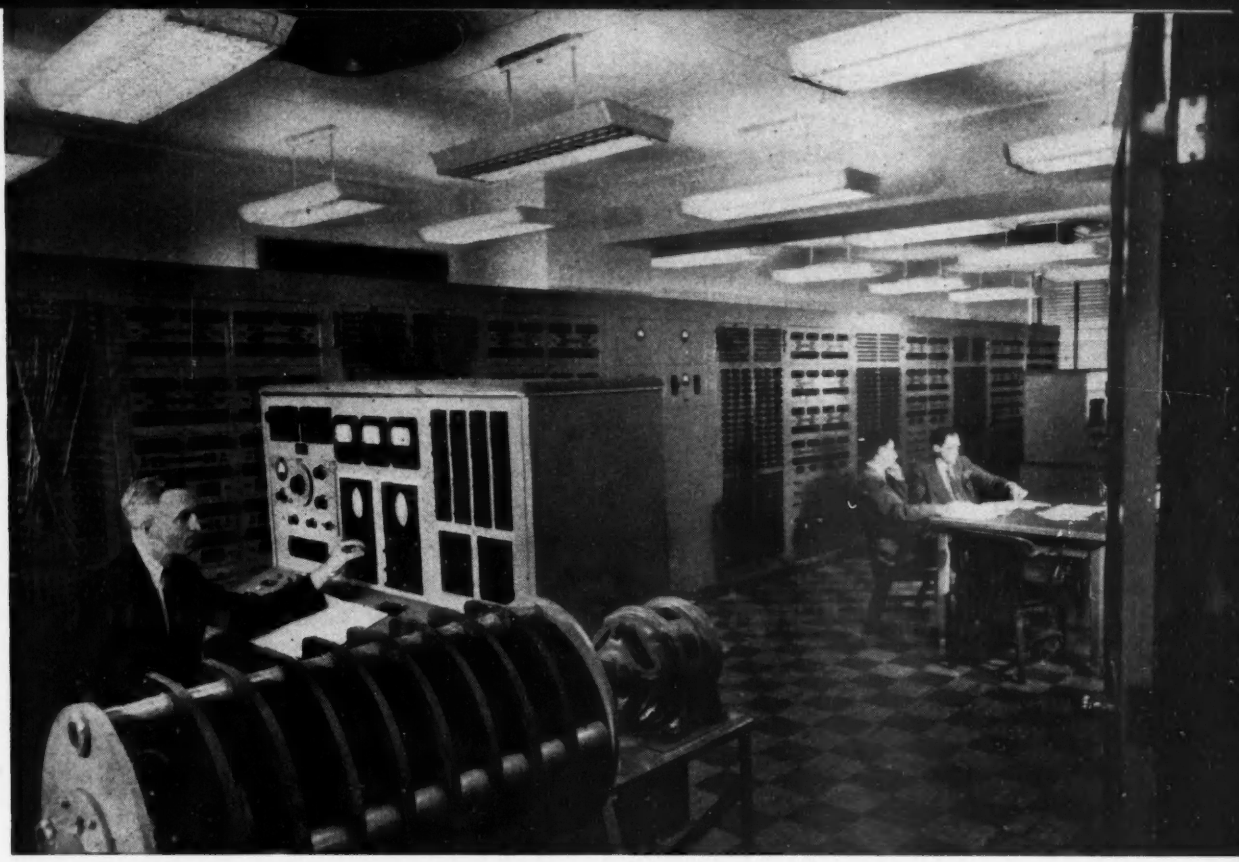
This discussion is not intended to show that duct splicing is necessarily something new or different, or to indicate that great economies can be effected. It has been found that duct splicing, when done properly, is not an inexpensive way of obtaining a required cable length. It is doubtful if any great saving can be made when cable deliveries are good.

Economics of duct splicing for the type of cable used in the illustrated procedure are shown in the accompanying set of curves. These curves are based on current labor prices and cost of scrap cable. They indicate how many pieces of cable—and therefore number of splices (always less one)—that may be joined without exceeding cost of new cable. Similar curves could be made for other sizes of cable.

Definite decreases in life of duct-spliced cable compared with new cable must be expected. However, no attempt was made to correct the curves for this decrease in life, as this would only be a fair estimate at best.



10 ECONOMICS OF DUCT SPLICING is based on cost of labor and scrap cable. To make a 300-ft length of cable up to 11 pieces may be spliced without exceeding cost of new cable



SYNCHRONOUS SWITCH in foreground applies repetitive disturbance to miniature system set up on plug board. Resultant voltages appear as standing waves on oscilloscopes built into control console. These traces are photographed when permanent test records are required

Anacom Solves System Transients

CHARLES L. WAGNER, Electric Utility Engineer, Westinghouse Electric Corp, East Pittsburgh, Pa.

An analog computer known as Anacom provides quick solutions to power system transient problems which would be tremendously laborious and time-consuming by classical or "brute force" methods. In addition to the conventional electrical transients, it solves the mechanical, hydraulic and thermal transients less commonly encountered.

Anacom resembles the ac-network calculating board in appearance, but its operation is quite different. The progressive series of adjustments required for step-by-step transient solutions are eliminated. And its solution appears as a trace on an oscilloscope for visual or photographic observation. A single set up suffices for any system disturbance, and the effect of corrective measures can be seen immediately. The new computer should be considered by planning and design engineers for many difficult applications.

Precision resistors, special low-loss inductors and capacitors, and transformers are used to duplicate a power system in miniature. Plug boards like those of the ac calculating board provide for flexible connections of these circuit elements. And a control desk facilitates measurement of the transient phenomena. The most obvious difference between these two tools is the synchronous switch used to represent the circuit breaker operation or other disturbance which initiates a system transient.

This switch might be called the "heart" of the computer. It consists of eight elements which open and close ten times a second. Its main job is to initiate the transient on the miniature system. The repetition rate of ten times a second causes the solution of the problem to appear as a standing wave which is readily viewed and recorded on an oscilloscope.

The switching repetition rate may be varied for certain applications. For some problems 20 times per second may be required, while once per second is used occasionally. A single-shot technique also has been used with results recorded by curve drawing oscillograph.

Uses Two Types of Analogies . . . Problems studied on the Anacom may be divided into two general classifications:

1. Mathematical analogies.
2. Direct analogies.

Derivation of the mathematical analogy can be demonstrated by an example of a mechanical system. The force equation for mass M is

$$f_M = M \cdot a$$

If "a" is expressed in distance x and time t, this equation becomes

$$f_M = M \frac{d^2x}{dt^2}$$

The voltage equation for an inductor L in an electrical system is

$$e_L = L \frac{di}{dt}$$

Because current i is the rate of change of coulombs q, then

$$e_L = L \frac{d^2q}{dt^2}$$

Comparison of these equations shows that if q is proportional to x and L is proportional to M, then e_L will be proportional to f_M. Similar analogies are capacitance for a mechanical spring and resistance for velocity damping.

A mechanical system is essentially undamped, unless a dashpot or similar element is included. Because resistance is equivalent to damping, it should be kept to a minimum in the electrical analogy. Reactors used on the ac board had excessive losses for mechanical system representation and new low-loss reactors had to be designed for the Anacom.

1. Shaft torque during fault

Short circuits on large turbo-generators produce air gap torque which is transmitted through the shaft to the turbine. These torques produce high stresses in the shaft which could cause it to fail. The problem is not just to use as large a shaft as possible because the large shaft might fail where a smaller one would not.

The equivalent mechanical system has three masses connected by two springs which represent the shafts. This system has two natural frequencies. If the air-gap torque contains a frequency near one of these, torque build-up would be severe. But it is possible to reduce the torque by changing the size of the shaft, thereby changing its spring constant and the natural frequency of the system.

The analog consists of three inductors and two capacitors. Voltage input represents air-gap torque, and voltage across the capacitors indicates shaft torques.

Short-circuit torque consists of fundamental frequency, second harmonic, and damped dc. The forcing function to simulate these components is shown below. When switch S is open, condenser C_0 is charged through resistor R'. When the switch closes, C_0 discharges through resistor R_0 and inductor L_0, causing an oscillation of frequency

$$f = \frac{1}{2\pi \sqrt{L_0 C_0}}$$

which is made equal to the fundamental.

In similar manner the second harmonic component is obtained by a new combination of L and C. The dc component is obtained by discharging a condenser through a resistor. The three components are combined on the slide wire and applied to the analog.

Shaft torques are read by an oscilloscope as voltages across the capacitors. If results indicate dangerous stresses, remedial methods are incorporated in the analog.

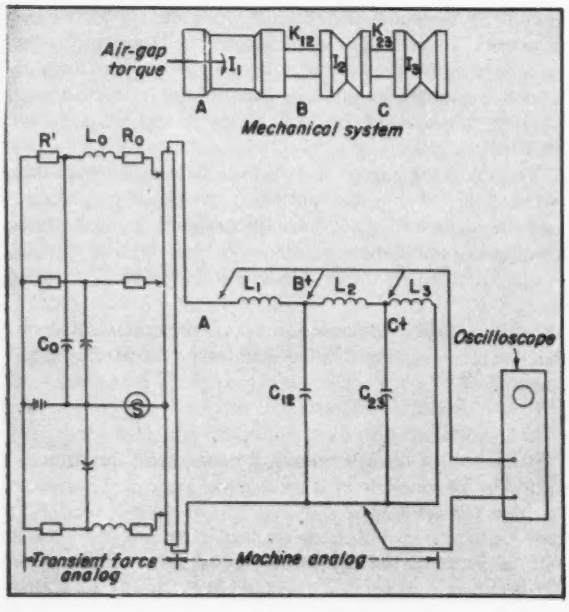
Steady-state vibration is measured on the same analog by driving it with a variable frequency power supply.

2. Station lightning protection

Lightning protection for a substation transformer also lends itself to Anacom investigation. Variables are arrester voltage, length of lead, distance of transformer from arrester. These factors determine the voltage which can occur at the transformer and the BIL required.

Analog for the lightning arrester and lead is capacitance shunted by a battery representing discharge voltage; this shunt circuit is applied by the synchronous switch S_1. The bus impedance for distance S is introduced as *I-C* pi sections, and the transformer attached as its equivalent capacitance C. To this a repetitive flat-top voltage wave

1



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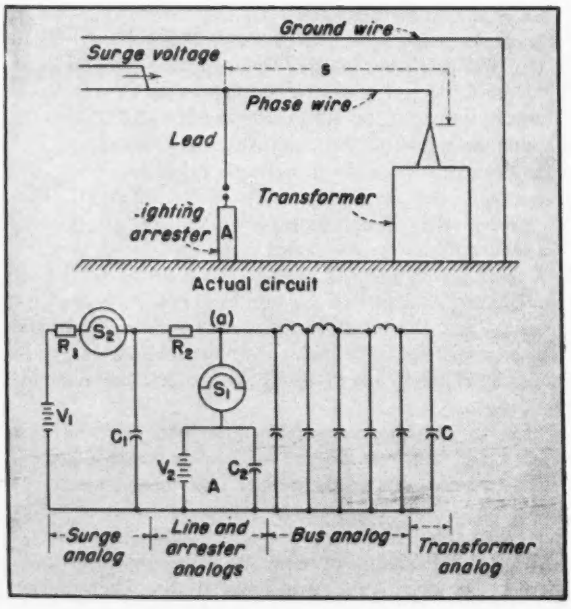
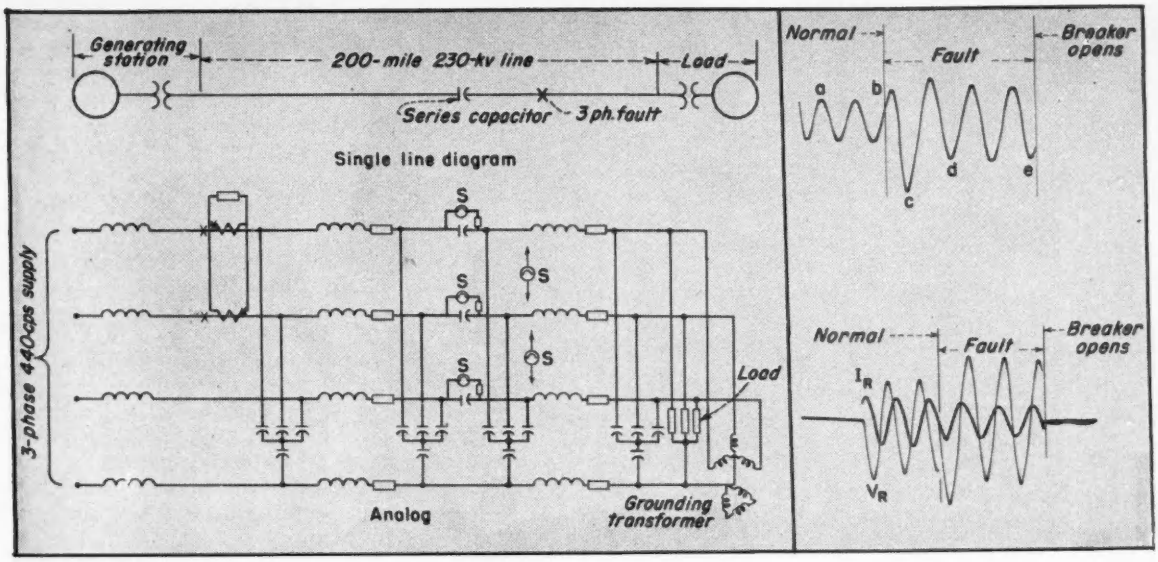




3

is applied through line surge impedance R_s by a second switch section S_2. Surge voltages at the transformer and other points are measured by the oscilloscope and curves are drawn to interpret the results.

3. Relaying series capacitor

The second classification of Anacom studies, the direct analogy, uses a circuit identical to the system except on a smaller power level. Typical case is the effect on transmission line relaying of series capacitors installed to increase the steady-state stability limit of the system.

The analog of the system is set up on a three-phase base. Synchronous switches around the capacitors represent the capacitor protective gaps. Faults are applied by means of other synchronous switches at various points on the system. And relay currents are obtained by current transformers in the phase leads.

Typical solutions are photographed from the oscilloscope screen. They show the series capacitor voltage, and the relay current and voltage during a system fault.

4. Switching surge voltage

Transient overvoltages which occur when a transmission line is energized or de-energized may damage insulation or cause arresters to operate. The analog is set up three phase similar to the series capacitor system, but for simplicity just one phase is shown in the diagram.

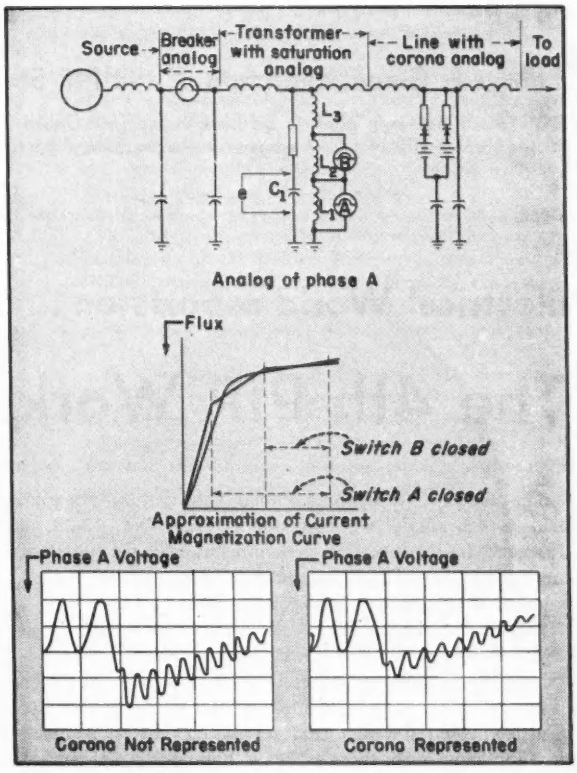
Corona is represented by two batteries, two diodes, and a capacitor. Each battery and diode set represents the critical voltage by passing corona current when the line voltage exceeds battery voltage. One set represents corona for positive voltage; the other, negative.

Transformer saturation is represented by an equivalent T with a variable inductance magnetizing impedance leg. Variation is accomplished by connecting the synchronous switch to bypass portions of the inductance. Thus the normal magnetization curve is represented by three straight lines. the slope of which determine the magnetizing impedance. Voltage across a capacitor C_1 indicates the flux, and the magnetization curve then shows which switch or switches should be closed to represent the correct magnetizing impedance.

A model transformer is used on some studies to represent this saturation effect.

The effect of corona on a line during a de-energizing operation is shown by comparison of the two oscillographic traces. For this case, transformer saturation was not represented.

4



John E. Canfield, left, chairman of the conference:

"The purpose of this conference is to provide you with inspiration and information which will make you want to take action to back up the nation's leaders with grass roots informational activities."

Thomas E. Murray, member, Atomic Energy Commission:

"I am very glad to be able to tell you officially today that the commission has embarked on a program to construct a full-scale power reactor with a minimum capacity of 60,000 kw." (EW, Nov. 2, p. 74)

Robert E. Ginna, chairman of the PIP Steering Committee:

"I am not only glad to be here today (Mr Ginna is recovering from an automobile accident), but I am glad to see nearly 200 of you engaged in the work and getting the benefits of this conference."

Electrical World reports on . . .

The 4th PIP Workshop Conference

The Electric Companies Public Information Program held its 4th annual workshop conference, Oct. 22-23, at Chicago. Its three-session program included six speeches, three panel discussions, a number of reports, and a presentation of the "Better Living Television Theater."

Key conference speaker was Kinsey M. Robinson, president, Washington Water Power Co. His talk, "Your Responsibility in Getting Things Done," gave the high points of his struggle to save his company from public power. But it also stressed the fact that no matter how hopeless a situation may look, there's always hope for a fighter.

"Back in 1938 when I came with Washington Water Power as president," he said, "prospects for survival looked mighty grim. One day I was called East, and in talking with executives I was told in so many words: 'We want you to go over there and see if you can save the company from public power. We want you to see if you can save private enterprise if it isn't too late.'

"At that time the two largest cities in Washington, Tacoma and Seattle, were already served in whole or part by public power. Tacoma, in business since 1905, claimed the lowest power rates in the nation. Seattle also

had been unusually successful, and several smaller communities had turned to municipal ownership. In addition the federal government was talking of the greatest hydroelectric development in the world, and 29 of 39 counties in the state had turned to public power in some form. It looked to some of my friends like an invitation to disaster.

"But in technical fields and load building WWP had done a good job. Half of the farms in the state boasted electricity. And the company's residential customers used twice the average national of energy at a rate which halved the national average.

"We'll Lick the Pants Off Them" . . . Yet this looked like a good place to stop. A good electric company was certainly headed for the cemetery. The unfortunate thing was the fact that some of our people did not take the public power gains seriously. One prominent utility man with a legal background brushed off the PUD movement. 'It's unconstitutional,' he insisted. 'Let them organize; and when the time comes, we'll lick the pants off them in court. The PUD's can never survive.'

"To show you what a little extra effort will do, I want you to look at the narrow voting margins that started the PUD's. Lincoln County could have been saved from public power with an added 6% of favorable votes, Pend Oreille with 3%, Grays Harbor with 1%, Chelan with 300 votes, and another county with 50. As for the state there is no question in my mind but that the PUD movement can be credited to default. Of 559,898 voters only 152,487 bothered about the PUD's at the polls. Here was the most amazing act ever dreamed up by the socialist mind to drive private power companies out of the state; yet it became law by the slim majority of 3.8% of votes cast.

Robinson's Two Rules of Life . . . "How can all of us, how does each one of us achieve success in this all important program of staying in business? It is the whole message of my talk. I wish that the two rules that have guided me through life would guide you. First, you can never compromise with doubt if you want to achieve something. There must be a goal. And you must believe that you can reach that goal whether anybody else gets on the bandwagon or not. Second, each individual must himself start the lines of force moving and not leave it to somebody else.

"To my way of thinking no man can wait for favorable winds or look to chance if he even halfway understands the technique of getting things done. Having faced the nation's most powerful forces attempting to socialize the industry, having seen the company I represent all but sold to public power by some of the very people who hired me to tackle the job of saving it, I repeat, no one can afford to sit still. You've got to make calls if you want to win."

We're on Your Team . . . E. E. Kelley, president, American Bakers Association, assured the utility industry that the bakers are with the utility men in their fight for private enterprise. "We are oppressed by the instruments of government that we established a score of years ago. The trend is for increased taxation and for the government to take over more business activities. It's a good thing that we don't get as much government as we pay for."

Kelley praised the fine job being done by PIP companies and assured them of support of his organization.

Charles E. Parker

Central Surveys,

Notes From Opinion Surveys

(A report to PIP companies by Central Surveys, Inc)

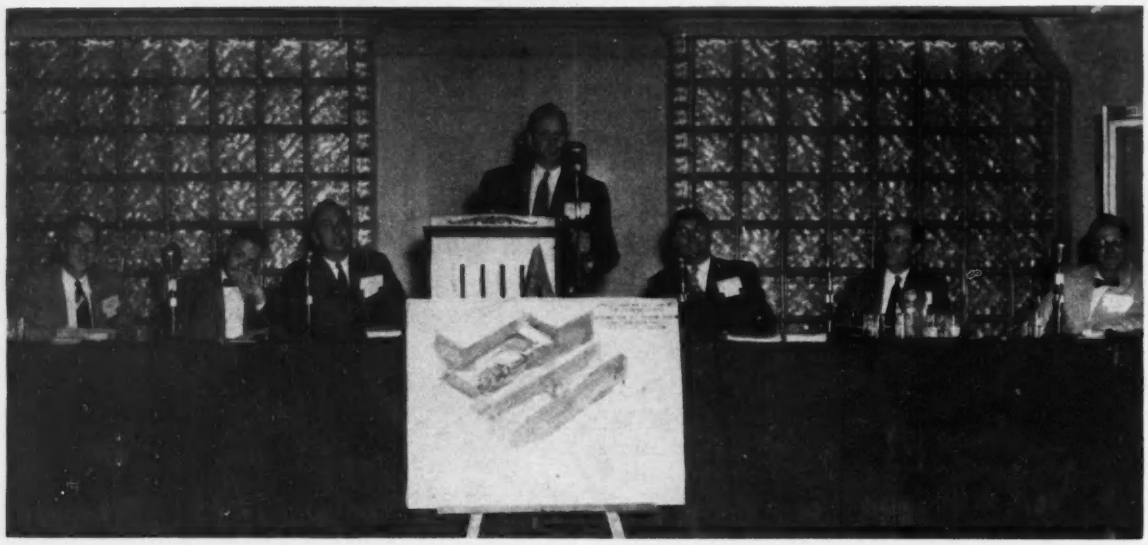
These reports of public opinion on various subjects of interest to private utility companies are based on studies made by Central Surveys:

- **Electric rate increases have had no noticeable effect on the general level of opinion regarding cost of electric service. At annual intervals since 1948 those surveyed have had a favorable opinion about the cost of electric service ranging from 66 to 70%. The last survey was 68% favorable.**

- **Employees are quite willing to discuss company problems with the public. But supervisors are more willing than non-supervisors, operating employees more than non-operating, and non-operating men more than double non-operating women.**

- **The saturation point as to what investor-owned companies are doing about government ownership and related subjects is far from being reached. Of all employees surveyed 57% want more information on what the company is doing about the threat of government ownership, 55% on relations with REA co-ops, and 50% on the threat of government ownership.**

- **While opinion-forming groups are highly receptive to denationalizing federal power facilities, it would be wise for the present at least to discuss such a move in general terms instead of in the terms of the proposal of Charles E. Wilson. The reason for this is that too many do not understand the Wilson proposal.**



NUCLEAR POWER PANEL gets an introduction from R. D. Furber, Northern States Power Co, session chairman. Panel members are, left to right, Titus LeClair, Commonwealth Edison Co; Dr Joseph Platt, University of Rochester; Fischer S. Black, editor of Electrical World and panel moderator; Furber; Dr John J. Grebe, Dow Chemical Co; G. H. Tuttle, Detroit Edison Co; and J. D. Luntz, editor of Nucleonics

Nuclear Power for Peace Offers Industry an Opportunity

Dr John J. Grebe, director of basic nuclear research, Dow Chemical Co—"There are many real compelling reasons for a privately financed reactor program based on economic and military requirements. While we are making plowshares in a normal, peacetime economy, we can have at the same time an immense capacity for making swords. Furthermore, private industry must be allowed to put the production of nuclear reactor products on a profitable and tax-paying, rather than tax-consuming, basis in order to reduce the overwhelming tax load which is destroying initiative, the foundation of our free-enterprise society.

"We believe that this is the best approach: Construct a full-size reactor provided with an exclusion area. Show that this reactor is safe so that others can be built in populated regions close to the power load. To cut first costs build initially only the reactor and integrated reprocessing unit. When a satisfactory reliability record has been established, add electrical generation and transmission facilities."

Titus LeClair, manager, Engineering Department, Commonwealth Edison Co—None of the nuclear reactors yet designed can be installed at a price near the cost of the boiler which it would replace in an electric power plant. Nor are operating costs known. It is estimated that the heavy water design reactor of Commonwealth Edison would produce power at the bus bar on a long burn-up basis at an overall cost of about 1¢ per kwhr. This is far from a discouraging figure. The cost of power from the first all-steam-turbine plant was higher than the cost from the old reciprocating engine plants. But it paved the way for increased efficiency and lower costs. A full scale nuclear power plant will do the same thing, and again it will take time."

Jerome D. Luntz, editor, Nucleonics—"Why are we pressing the development of nuclear power in this country? There are three reasons: 1. It is important for us on the international scene to be first with industrial nuclear power. 2. There is always the possibility that we can achieve economic nuclear power much sooner than anticipated. 3. There will undoubtedly be unpredicted, important by-product developments."

Dr Joseph Platt, chairman, Department of Physics, University of Rochester—"The United States can make a real contribution toward winning the peace for the free world by leading the way to the large scale economic development of nuclear power. This calls for the drive of private industry as well as for the resources of government.

"The day is fast approaching when the public will have to know answers to certain questions such as these: Will a nuclear power plant in our neighborhood be dangerous? Will it provide good employment opportunities to our young people? How will nuclear power affect our power rates? For these questions each electric power company must develop answers."

George H. Tuttle, director of public information, Detroit Edison Co—"In spreading information on nuclear power there are a few facts to remember. Give every cooperation to the press, but keep information simple and factual. Emphasize that there is no known method of getting usable electric power directly from the fissioning of the atom. Uranium is just another source of heat energy like coal, oil, and natural gas.

"The economic possibilities of nuclear power are tremendous. One pound of uranium costing $35 will produce as much heat as 1,300 tons of coal. To compete coal would have to sell for 3¢ a ton.

Youth Can Appreciate the Industry Story

R. Harold Anderson, supervisor of employee information, Washington Water Power Co—"One purpose (of the youth program) is to establish the company as a friend in the eyes of young people who some day will be our customers. WWP has found Reddy Kilowatt invaluable in identifying our company as a friendly institution. Our employees then become humanized Reddy Kilowatts as the company encourages them to take part in community youth programs. Another purpose is to tell the American business story to young people. This has been done in many ways."

Edmund Lieberman, public relations, International Harvester Co—"In working with youth groups our general aim is communicating a basic economics story. Doing this we talk most about what we know best, our own company. We try to interpret it as an example of the capitalistic system at work. The objective is to have the public think of International Harvester as a good place to work, a good company to which to sell, a good company from which to buy, a good company to have as a citizen in the community."

Will W. Bowman, publicity and advertising director, Utah Power & Light Co—"Reddy Kilowatt came to our territory in 1937. A well-rounded community and customer relations program utilizing Reddy was set up later that year in anticipation of a municipal power plant election in Ogden. A Reddy Kilowatt Youth Club was formed in cooperation with a radio station. Club members appeared in radio shows. There were two a week, after school, and a big show for the winners of these one Saturday a month. Finally there were grand prize winners for the season. The club is no longer functioning. But a spot check of the 'old-timers', now 23 to 29 years old, made some time ago indicated that all had pleasant memories of the club and not a one was antagonistic to the company."

Jack L. McDonald, director of special services, Arizona Public Service Co—"Two simple devices are used to convey the American story and the industry story to our classroom audience. One is a chocolate cake. The other is a basket filled with miniature products of American industry and topped by a miniature power plant. Our talk deals with America, and the story of freedom becomes the story of the electric industry. A student, Mr or Miss America, inherits the contents of the basket. The cake is sliced (later eaten) to represent our current annual report pie chart."

M. B. McDonald, secretary, Florida Power & Light Co—"We have been using three radio shows. A Saturday morning kid show featuring Reddy Kilowatt is held in neighborhood movie theaters with a professional master of ceremonies. Parts of the show are recorded for broadcast later. A "Sportlights" program featuring high school athletics and other activities is built up from interviews secured in schools with a recorder. A cooperative 13-weeks program was developed in the University of Miami radio and television laboratory on historical Florida events."

Employees Willingly Speak Out for the Company

Robert C. Cox, publicity manager, Philadelphia Electric Co—"Our Speakers Bureau is organized and administered entirely by employees regardless of their position. The outside instructor is paid by the company. These policies seem to be very satisfactory. Speaking engagements have been confined almost exclusively to charity drives. Telling the free enterprise story to civic groups is a function of authorized company spokesmen. Rank and file employees are not encouraged to engage in public speaking activities as company spokesmen."

D. L. Fenner, manager of employee education, Central Hudson Gas & Electric Corp—"Our Speakers Bureau was organized on a volunteer basis to present the Niagara Redevelopment Program to our customers. Some 60 employees responded. They were given six hours of speaking training, a 20-minute speech, and a flip chart. But speakers could use the speech and charts as they saw fit. Employees were encouraged to speak to any group that would listen. Over 4,000 customers got to hear the story. As a result many groups passed resolutions favoring private development of Niagara."

Dal Foreman, public relations, Dayton Power & Light Co—"We conducted a speech course for commercial personnel. Then we gathered information from all departments on the programs they could present. Resumes of these were published in a booklet. District managers distributed them to clubs in their areas. Results are difficult to measure. But the home service department is contacting 125% more people through mass meetings than before booklet was distributed. We have received many favorable comments."

Donald J. McGowan, director of public relations, Consumers Power Co—"In my opinion a speakers bureau should not be part of an employee information program. A speaker representing a utility must be thoroughly grounded in many phases of the business so that he can answer questions. So his training must be much broader than can be given in an information program designed for large numbers of rank and file employees. Charts and slides can be valuable aids to a speaker. They often help to simplify a proposition."

John O. Gunn, manager of public relations, Cleveland Electric Illuminating Co—"For many years the company has provided employee speakers on request for meetings of service and community organizations. Impressed by the results, the company this fall decided to formalize the service and promote such talks through a speakers bureau. With the exception of one outstanding professional speaker specifically engaged for the purpose, all speakers are volunteer employees."

'Come, Let Us Reason Together'

Clarence A. Davis, solicitor, Department of the Interior, explains to the PIP workshop conference the problem of interpreting the diverse federal power laws

Quoting from the Bible, "Come, let us reason together," (Isaiah 1:18) Clarence A Davis, solicitor of the Department of Interior, invited those at the Thursday dinner of the workshop conference to come to an understanding on the role of government in the power industry.

Pointing out that on the one hand there are those who would limit federal government activity in the power industry to selling falling water at irrigation and flood control dams, he said that on the other are those who would socialize the entire industry. "Is it possible," he asked, "to reason together?"

Clarence A. Davis

Common Sense Will Prevail . . . "My faith in the great body of American citizens who are not zealots for either of these views," he continued, "leads me to feel that once they know the facts, they will follow, as they have so often, the common sense view.

"I have also noticed that many of the problems of the utility business are not substantially different whether properties are operated by public or private agencies. There are certain fundamental problems which the laws of economics compel either group to consider. It is my purpose to point out some of these and to raise questions as to what their solution should be. If I can only succeed in clearly stating the problems, I shall have contributed much toward their solution."

All Suppliers Must Make Money . . . The solicitor first established the difference between the private companies and the federal agencies by saying, "The one is engaged in the business as such. The other, at least under the federal statutes, is engaged in the business in a purely incidental way." He pointed out that while private companies must make a reasonable return upon their investment, the government must sell the energy from its projects at a rate to make possible repayment to the Treasury with interest of the money invested by Congress in the projects."

This leads, he said, to the question, "How do we determine the rate or cost base for federal projects?"

What Is the Capital Base? . . . Davis said that for every federal project there is the problem of first determining the fixed capital base. Under the law only "that proportion of the total cost which is fairly chargeable to the irrigation and electrical installation is what Congress calls a reimbursable item." Many federal projects have other non-reimbursable items such as flood control, navigation, and recreation. It is next to impossible to put a dollars-and-cents value on these non-reimbursable items. The result is a constant haggle over allocation of costs.

Because this is an era of rising costs, many federal projects represent an investment of 150, 200, or sometimes as much as 250% of the original estimated cost of the project. Rates must be fixed to recoup the investment with 2½% interest. But in many cases rates have been based on the original and not the true cost. These cannot produce the required statutory return on the federal investment.

Another of the problems that arises is the marketing of federal power under the so-called preference clause. This usually reads something like this: "Preference in the sale of such energy shall be given to public bodies and cooperatives."

How Far Does Preference Go? . . . As to the meaning of this clause Davis brought up a number of hypothetical situations. Assume that a federal project has a capacity of 100,000 kw and within 100 miles the preference bodies can use only 50,000 kw. Then what happens to the other 50,000 kw. Is the federal agency to keep extending its lines until it finds enough preference customers to absorb the entire amount? Advocates of extension of federal power take this stand.

On the other hand if the federal agency is not to extend its lines over a reasonable (whatever that is) distance, is the power to be allowed to go to waste or sold as dump power at low rates? In this case the taxpayers are being deprived of the full return on their investment.

Domestic vs Industrial Customers . . . All of the federal power laws indicate that the power is to be primarily for the benefit of domestic and rural users. What shall the federal government do when a preferred customer sells a large block of power to one or more industrial users at the expense of domestic and rural customers?

What is to be done when the preference customer of today can use only half the output of a project? Is the government obligated to keep the remainder in reserve for the growing needs of the preference customer?

"I have tried to approach these problems with understanding and with thoughtfulness. The solution has much to do with the welfare of the electric user and of the taxpayer.

"The policies adopted have a great bearing on the future of the United States. And we hope they can be solved wisely and decisions can be made fairly between the various contending forces that are sometimes far too bitterly contesting their position."

WASHINGTON COMMENT

JESSE MOCK

Republicans are going cautiously about the task of putting their own mark on the federal rural electrification program.

Take the touchy and often controversial problem of loans for generating and transmission facilities. This portion of the federal loan program had all but come to a halt during the last two years of the Truman Administration. Few if any loans were made to new borrowers during that period though a number of applications were being pushed.

What Is the GOP Policy on G&T Loans?

When Republican Ancher Nelsen took over as head of Rural Electrification Administration in May, he was confronted with group after group of rural co-op men who wanted an answer on these applications. He met with each of them and promised early consideration of their appeals. But it was clear that he was not immediately prepared to deal with specific applications.

After all, some of these had been filed years previously, and long and tedious studies had been conducted on them. Nelsen needed more time to study them and to evolve some guides for dealing with them.

Nelsen Sounds Like a Democrat . . . By early this month he was ready to talk in a general way as to how he would meet this problem. He has made no sweeping policy changes, but he has brought a new attitude to these problems that had come near to stymying the Democrats.

These are points he likes to make:

- "We have made absolutely no change in REA's long-standing policies concerning G&T loans."
- "About one-fifth of the amount loaned in the electric program since we took office has been in the G&T category . . . Most of them made so far have been for transmission."
- "We have several applications from new G&T borrowers under study at this time, and there is every reason to expect approval if they meet the established loan standards."

Nelsen sees the G&T loan authority not only as a means of bringing electric power to the distribution co-ops directly but also as a "bargaining power" which the co-op might use to get reasonably priced electricity.

On these points, it is apparent that Nelsen has a wide area of agreement with his Democratic predecessors at REA. They thought like this and talked like this.

Where, then, does he differ?

It is in tackling specific applications. First of all he wants to be sure that a G&T loan is the very best and most reasonable way of getting reasonably priced power to distribution co-ops. He told a recent meeting in Washington:

"I am somewhat concerned about our figures which in the aggregate show that power procured from REA-financed plants at the present time is more expensive for the borrowers than that purchased from any other source."

Trying to Avoid Mistakes of the Past . . . He is demanding that rigid engineering studies be made of each application and that alternatives be fully explored. There are indications G&T loans made in the past have not measured up to expectations. Cost of production of several of the co-op generating plants were underestimated—putting a burden on the co-op consumers who must pay the higher rates. He is determined that applicants will have a complete picture of what they're in for before he grants a G&T loan.

Second, Nelsen is stressing "industry-wide cooperation" as an alternative to government-financed generating and transmission facilities. This means making full use of electric company or other existing facilities where this can be done on a fair basis.

This calls for a much wider degree of cooperation between the various segments of the electric utility industry than has been evident in the past. Nelsen has already given evidence that he will take an active part in fostering such cooperation.

His attitude seems to add up to this: He is squarely behind the REA G&T loan program when and if it is needed. He does not intend to use it to put rural co-ops in wasteful competition with other producers of power.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Single-phase oil circuit reclosers will be in increased usage on 60% of the utility systems relative to multiple-shot reclosing fuses. However the trend is toward three-phase reclosers because they afford protection against single-phasing (AIEE Committee Report).

Generator transient reactance and short circuit ratio have little influence on stability margin. System reactance is the large factor.

Gypsum plaster can be decontaminated by plain water after exposure to harmful radioactive deposits more readily than with cleaning agents.

Cable sheaths have been badly corroded by the alkalinity of the new concrete ducts in which the cables were placed. Drainage or periodic flushing helped.

Perfectionism in the research laboratory may be as much a handicap to commercial success as premature release of an inadequately perfected product.

Aluminum-antimony alloy can be used to convert light to electrical energy and further promises to be a relatively cheap substitute for germanium in transistors.

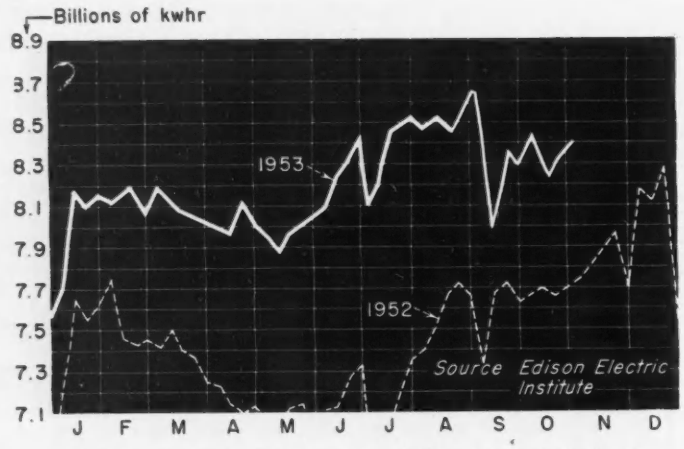
Utilities with good safety records are almost invariably those which have unequivocal executive support for a thorough-going accident prevention program.

Aluminum alloy sheet is being longitudinally butt-welded to make heat exchanger tubes at lower cost than drawing seamless.

Bundled conductors of the same phase tend to be pulled together by magnetic forces arising out of load currents and fault currents.

Direct lightning strokes to transmission-line overhead ground wires will run 0.4 per mile near stations where the isokeraunic level is 20 to 25 thunderstorm days per year. For station shielding it will be about 0.04 per acre of station area.

STATISTICS



Output Week Ended Nov. 7—8,397,523,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Nov. 7	+7.6	+5.4	+3.0	+1.9	+5.5	+18.8	+3.0	+6.9	+23.1	+6.5
Oct. 31	+7.9	+5.9	+3.5	+3.1	+5.9	+18.9	+3.8	+6.5	+22.9	+4.4
Oct. 24	+7.9	+6.1	+2.9	+2.5	+4.2	+17.8	+11.3	+6.8	+24.6	+4.0

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Aug.	77.1	76.8**	69.7
Capacity (Million Kw)	Sept.	87.59	86.63	78.76
Production (Billion Kwhr)	Sept.	37.04	38.50	33.38
Hydro	Sept.	7.59	8.45	7.36
Fuel	Sept.	29.45	30.04	26.02
Fuel Consumption				
Coal (Million Tons)	Sept.	9.70	9.70	8.84
Oil (Million Barrels)	Sept.	6.16	6.55	6.05
Gas (Billion Cu Ft)	Sept.	105.30	112.88	96.38
Sales (Billion Kwhr)	Aug.	32.82	32.13	29.39
Residential	Aug.	8.48	8.47	7.53
Commercial	Aug.	5.98	5.81	5.46
Industrial	Aug.	15.83	15.50	14.10
Other	Aug.	2.52	2.35	2.30
Net Income Class A & B Companies ($ Million)	Aug.	77.43	74.11	69.39
Estimated Dec. '53 Peak (Million Kw)	Aug.	86.2	86.2	88.4
Kwhr per Residential Customer (12 Month Average)	Aug.	2,289	2,273	2,119
Revenue per Kwhr Residential Service (12 Month Average)	Aug.	2.76¢	2.76¢	2.76¢
Canadian Production (Billion Kwhr)	Aug.	5.09	5.18	4.97

Business Statistics

FRB Industrial Production Index†††	Sept.	236*	238**	232
Gross National Product Annual Rate ($ Billion)	2ndQtr.	372.4	362.0	345.1
EW 5 Industry Production Index	Sept.	128.9	129.2	125.8
ENR Construction Cost Index††	Nov.	128.1	128.0	123.4
BLS Consumer's Price Index	Sept.	115.2	115.0	114.1
NEMA Insulation Materials Sales Index†	Sept.	153	153	142
NEMA Electric Appliance Sales Index†	Sept.	101	90	105
NEMA Household Refrig. Sales Index†	Sept.	62	63	69
Metal Prices (Nov. 10)				
Copper, Conn. V., lb		$.29-.30	.29-.30	.24¼
Lead, N. Y. lb		.13½	.13½	.14½
Zinc, prime Western E. S. Louis, lb		.10	.10	.12½
Tin, Straits, qual. N. Y., lb		.81	.80-.81	1.21¼
Aluminum, ingot, base price		.21½	.21½	.20
Nickel, base price		.60	.60	.56½
Steel billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1 heavy, Pitts., ton		36.00	36.00	46.00

*Preliminary **Revised †1947-49=100 ††1949=100 †††Unadjusted

Domestic Use of Energy Doubles in 10 Years

Over the last decade, the average residential customer has more than doubled his use of electricity. In 1942, average annual use was 993 kwhrs.

Customers—1952

	Number	% of Total
Residential	30,728,182	81.2
Rural	2,117,188	5.6
Commercial and industrial	4,870,809	12.9
Public street and highway lighting	28,459	.1
Other public authorities	102,640	.2
Railroads and railways	112	0
Interdepartmental	355	0
Others	3,921	0
Other electric utilities	3,880	0
Total customers	**37,855,546**	**100.0**

Last year it reached 2,069. For such usage, the consumer paid an average of $59 for the year, while the companies' revenues from these sales totaled $1.8 billion, which represents

Kwhr Sales—Thousands

		% of Total
Residential	63,569,836	19.1
Rural	10,579,952	3.2
Commercial and industrial	189,530,166	57.0
Public street and highway lighting	2,900,313	.9
Other public authorities	7,646,587	2.3
Railroads and railways	4,661,196	1.4
Interdepartmental	864,264	.3
Others	1,618,709	.5
Other electric utilities	50,941,962	15.3
Total sales	**332,312,985**	**100.0**

32% of all revenues of the larger private utilities, as reported in the Federal Power Commission's annual report.

A little over half of utility revenues come from industrial sales which totalled 190 billion kwhrs in 1952.

Revenues

		% of Total
Residential	$1,813,075,981	32.0
Rural	228,768,979	4.0
Commercial and industrial	2,888,555,057	51.0
Public street and highway lighting	92,856,743	1.7
Other public authorities	107,401,262	1.9
Railroads and railways	46,345,675	.8
Interdepartmental	3,542,829	.1
Others	3,709,098	.1
Other electric utilities	410,459,253	7.2
Other electric revenues	65,702,131	1.2
Total revenues	**5,660,417,008**	**100.0**

Here the average usage shows an increase of 44% over the decade, from an average of 26,989 kwhrs in 1942, to the 38,911 of last year.

Rural service accounted for 5.6% of the customers, about 3% of sales and 4% of revenues. The other categories when combined account for quite small percentages of the totals.

FINANCIAL

Georgia P&L Gets Hike . . .

. . . in rates of $128,401 a year from PSC. In dissenting opinion two commissioners ask for show cause order why company should not buy all its power from Georgia Power Co

In what may be a far-reaching and controversial rate order in which a strong dissent was made by two of the commissioners, the Georgia Public Service Commission gave Georgia Power & Light Co a temporary rate increase of $128,401 on Oct. 27 (EW, Nov. 9 p10).

This second supplemental order resulted from a petition for a rehearing granted by the PSC on Sept. 2. The rates are subject to review in six months.

Numerous Errors Alleged . . . The order stated that "The company alleged numerous errors in the original decision in its petition for rehearing." It went on to say "with the exception of the adjustments reflecting the change in circumstances, each of the adjustments was considered in the initial decision. Certain of these adjustments were adopted by the PSC and others were excluded from consideration for the reasons stated in the decision.

"It is with respect to the exclusion of certain adjustments that the company alleges error in the decision. It appears, therefore, that there are two major considerations with respect to the record in this case. One, a review of the adjustments excluded and second, consideration of changed circumstances."

Company Earning 5.5% . . . In a strongly dissenting opinion, Commissioners Walter R. McDonald and James A. Perry said, "We are unable to vote for the substitute motion offered by Commissioner Crawford L. Pilcher and adopted by the majority of the PSC . . . for the reason that such action will defeat and nullify the objectives of our original resolution and for the reason that the company is now earning approximately 5.5%."

The resolution went on to say, "WHEREAS, said distributing company purchases all of the electricity . . . from its parent company. . . [at] an average price of 9.4 mills per kwhr, and

"WHEREAS, this commission has prescribed for application by the Georgia Power Co within the state of Georgia wholesale electric rate schedule 'WR-4' available to municipally owned distribution systems and REA co-ops, and an industrial use schedule available to industrial plants and under which latter schedule the Georgia P&L could have purchased its energy requirements at an annual saving of $311,567 and if its requirements had been purchased under the 'WR-4' schedule would have effected a saving of $659,609 . . ."

Therefore the dissent concluded, the PSC should reconsider its order that the matter be "postponed pending the issuance and disposition of a rule nisi directed to the Georgia P&L and to the Georgia Power Co calling on said companies to show cause why the Georgia P&L should not contract to purchase all of its electric power requirements from the Georgia Power Co and why that company should not arrange to provide such service at a reasonable and compensatory rate . . ."

The dissenting commissioners went on to say that the PSC should obtain an order from the Securities & Exchange Commission "which would provide for the divestment of the Georgia P&L from the Florida Power Corp and for the sale of said property at a fair value either to the Georgia Power Co or as a separate and independent operating entity whichever may finally be shown to be the best interest of the people of the area served."

As regards to the rate base in the PSC order, the company urges that this base, "determined as average investment capital . . . was not in accordance with the laws as decided by various decisions of the U. S. Supreme Court and the courts of highest resort of the several states and urged that it was essential for the commission to ascertain the value of plant and equipment."

"The commission has in numerous other cases used average invested capital as a proper measure of the investment in utility plant and equipment, and in this instance the average capitalization was used primarily to determine the overall earning requirements of . . . Georgia P&L . . ."

Net Investment Less Than Average Capitalization . . . The commission went on to say "The record clearly shows that accrued taxes are an adequate source of such [working] capital. It is noted that the . . . net investment is less than the average capitalization of the company for the same period. It appears that the determination of the earning requirement as set forth in the initial order based on the overall capitalization of the company is more equitable to the company than the use of the net investment rate base . . ."

As to the depreciation reserve, the commission said, "The company urged that the full depreciation reserve recorded on the books of the company should not be deducted in the determination of the rate base and that only the amount provided from operating expenses should be used.

"In the argument in support of the contention, counsel for the company quoted the decision of the commission in the Southern Bell Telephone & Telegraph case (Docket 195-U) in which the statement was made that the best measure of accrued depreciation is the reserve accumulated through charges to operations. However, in that case the full depreciation reserve was accumulated through charges to operation and the resulting reserve balance appeared to be entirely adequate. . . . On the other hand, substantial credits to depreciation reserve from other sources have been made by Georgia Power Co. and Savannah Electric & Power Co in rate cases dealing with those companies, the full reserve has been deducted."

As to the rate of return, the commission denied the company's plea that in comparison with two other utilities its rate of return was inadequate.

Cost of Capital . . . As to the cost of capital, the commission stated "The company urged that the associated company advances listed in the initial order with an earning requirement of 6% should in reality be shown as common stock with a rate of 10%, since the advances were later repaid by an increase in the stated value of the common stock.

"While this fact is true, it is also a matter of record that Georgia P&L has issued $2 million principal amount of additional first mortgage bonds with an annual interest rate of 3⅞%. If consideration is to be given to the common stock increase, then likewise, consideration should be given to the additional bonds which have been issued, and the lower earning requirement on the principal amount of the new bonds would offset the higher earning requirement for common stock. However, this enters into a new period for which the results of operation are not a matter of record in this case."

As to the change in circumstances, the PSC mentioned the increases in Georgia P&L's expenses since the first decision was issued. These consisted of increases in wages, power purchased, and franchise taxes amounting to $128,400.

Rate of Return Unchanged . . . The PSC stated, "The granting of these items of cost to the Georgia P&L will not change the rate of return heretofore found as necessary in the commission's order dated May 11, 1953, and which order the commission adopted unanimously."

The PSC made a number of significant statements with respect to the cost of power purchased by the Georgia P&L from the Florida Power Corp. It mentioned that the cost of power purchased amounted to $2,377,257 at an average rate of 9.4 mills per kwhr.

"As a test of the reasonableness of this cost of power to Georgia P&L, the power requirements of the company have been applied to power purchase contracts in this area. According to this computation, the power cost to Georgia P&L would be less under these various contracts.

"If the current industrial rate of Georgia Power Co were applied . . . the cost of the above power would have been over $300,000 per annum less than it was. . . . If the current contract between Georgia Power Co and Georgia P&L were applied to the total requirement, the power cost . . . would have been approximately $115,000 per annum less than it paid. If the 'WR-4' rate schedule of the Georgia Power Co were applied, the total power cost would have been reduced about $650,000 per annum, or if the contract between Georgia Power Co and South Carolina Generating Co were applied, the cost of power would have been reduced over $60,000 per annum.

(*Continued on page* 224)

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1953									
Nov. 5	**3.06**	**3.11**	**3.32**	**4.16**	**4.35**	**4.62**	**5.21**	**5.67**	**5.77**
Oct. 29	3.07	3.12	3.35	4.18	4.37	4.64	5.18	5.73	5.77
END OF QTR.									
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.15	4.06	4.22	4.59	4.98	5.33	5.62

Data: Reis & Chandler, Inc.

EARNINGS

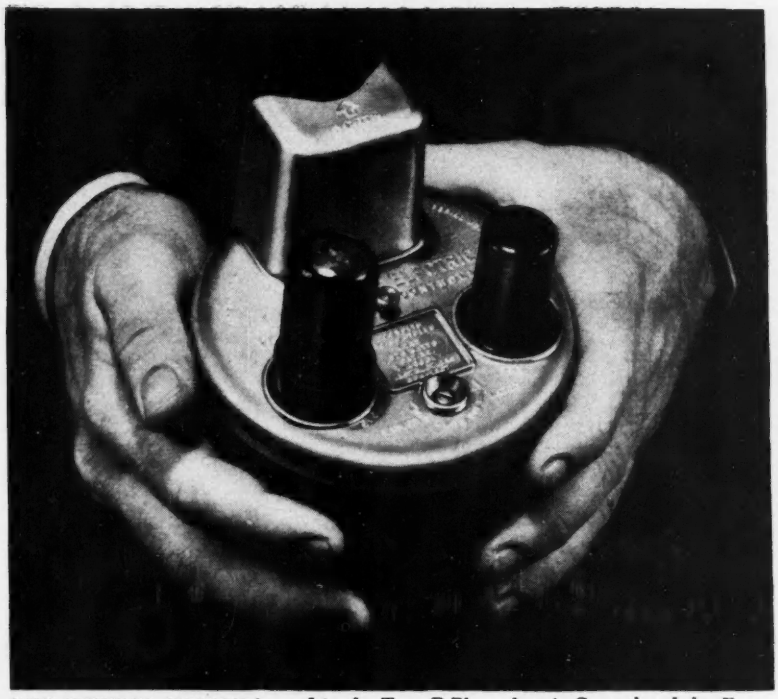
Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Arkansas-Missouri Power	12	Sept.	$822,111	$679,576	$....	$....
California Electric Power, consolidated	12	Sept.	2,813,762	2,367,008	.90(a)	.90(a)
Central Illinois Public Service	12	Sept.	5,717,351	5,340,026	1.40(g)	1.55(g)
Consolidated Gas & Electric of Baltimore	12	Sept.	10,877,549	9,872,077	1.92(b)	1.77(b)
Consumers Power	12	Sept.	23,523,386	20,113,957	2.97(c)	2.71(c)
Duquesne Light, consolidated	12	Sept.	15,095,658	13,628,224	2.18	2.07
Iowa-Illinois Gas & Electric	12	Sept.	4,463,813	4,114,586	2.26	2.16
Philadelphia Electric	12	Sept.	29,227,398	28,145,659	2.33	2.28
Southern California Edison	12	Sept.	21,895,574	22,890,199	2.57(e)	3.04(e)
West Penn Electric, consolidated	12	Sept.	13,872,962	12,444,997	3.28(f)	3.14(f)
Wisconsin Public Service, consolidated	12	Sept.	4,348,000	3,547,000	....	....

Notes—Based on shares outstanding at end of period; (b) Based on 5,213,866 shares in 1953 and 4,878,954 shares in 1952; (c) Based on 6,794,362 shares in 1953 and 6,176,693 shares in 1952; (e) Based on 6,249,727 shares in 1953 and 5,467,130 shares in 1952; (f) Based on 4,224,000 shares in 1953 and 3,960,000 shares in 1953; and (g) Based on shares outstanding at end of each period.

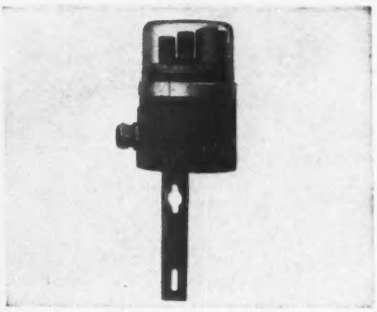
FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF NOVEMBER 5–11			
Long Island Lighting—1st mtg 3½% due 1983	$25,000	100.929%	3.45%
SCHEDULE FOR NOVEMBER—DECEMBER—JANUARY			
Bonds			**Bid Date**
Gulf States Utilities—1st mtg due 1983	$10,000	.....	Nov. 23
Illinois Power—1st mtg due 1983	20,000	.....	Nov. 23
Iowa Power & Light—1st mtg due 1983	8,500	.....	Nov. 30
Monongahela Power—1st mtg due 1983	10,000	.....	Dec. 1
Columbus & Southern Ohio Electric—1st mtg due 1983	10,000	.....	Dec. 1
Ohio Edison—1st mtg due 1984	30,000	.....	Jan. 19
Preferred Stock			
Worcester County Electric—75,000 sh $100 par	$7,500	.....	Nov. 17
Iowa Power & Light—50,000 sh $100 par cum (e)	5,000(a)	.....	Nov. 24
Duquesne Light—100,000 sh $50 par	5,000	.....	.....
Common Stock			
Columbus & Southern Ohio Electric—200,000 sh (b)	.....	.....	Nov. 17
Iowa Southern Utilities—100,000 sh (d)	.....	.....	Nov. 18
Arizona Public Service—240,000 sh (c)	.....	.....	Nov. 24
Maine Public Service—35,000 sh (to be offered commonholders on a 1-for-6 basis, record Nov. 24 to expire Dec. 8 with an oversubscription privilege)	.....	.....	.....
Delaware Power & Light—232,520 sh (to be offered commonholders on a 1-for-7 basis, record Nov. 25 to expire Dec. 15; employees to be given right to subscribe up to 150 shares)	.....	.....	.....
Central Illinois Electric & Gas—70,400 sh (to be offered commonholders on a 1-for-10 basis, record about Nov. 30)	.....	.....	.....
Virginia Electric & Power—558,946 sh	.....	.....	Dec. 1
Consumers Power—679,436 sh (to be offered commonholders on a 1-for-10 basis, record Jan. 7 to expire Jan. 22; employees will be given right to subscribe)	.....	.....	.....
Ohio Edison—527,830 sh (to be offered commonholders on 1-for-10 basis, record Jan. 11 with an oversubscription privilege)	.....	.....	.....

Notes—(a) Company has asked FPC to exempt the issue from competitive bidding requirements; (b) To be offered by an investment group headed by Dillon, Read & Co; (c) First Boston Corp—Blyth & Co, underwriters; (d) First Boston Corp, underwriters; (e) Smith Barney & Co, underwriter.



NEW CONTROL ELEMENT is used in the Type P Photoelectric Control and the Form 110 Luminaire shown at right. Its plug-in design permits convenient field servicing. New element is interchangeable with G-E photoelectric controls already in service.



TYPE P CONTROLS provide sensitive, low-cost photoelectric control of series or multiple outdoor lighting circuits.

FORM 110 LUMINAIRE combines Type P control and standard optical systems in one compact unit for multiple circuits.

New G-E Photoelectric Street-lighting Controls

Provide reliable service longer, need less maintenance, cost less

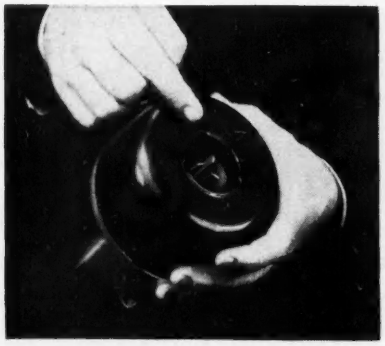
General Electric makes both separate photoelectric controls and complete photoelectric luminaires. Both now use an entirely new control element with an etched-circuit and dip-soldered connections. These new manufacturing techniques make possible a better, more accurate photoelectric control at a lower price.

G-E photoelectric controls give you light whenever its needed, regardless of the time of day. Power consumption is low, and the circuit design assures maximum tube life. The controls do not require adjustment while in service, and need no attention after power failures.

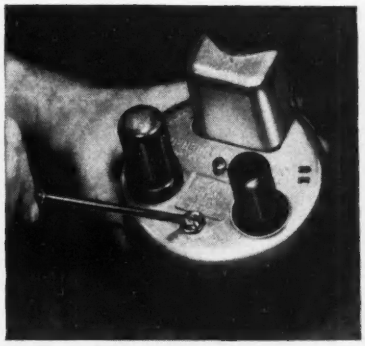
The new units are completely interchangeable with G-E photoelectric controls already in service. Enclosed in a standard glass meter cover for protection against physical damage, the control element plugs in, permitting replacement of the unit without reorientation.

For more information see your nearest G-E Apparatus Sales Office or Authorized Agent; or write for Bulletin GEA-5141 to *Section 452-136, General Electric Company, Schenectady 5, N. Y.*

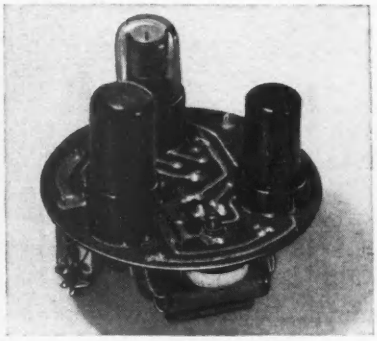
GENERAL ELECTRIC



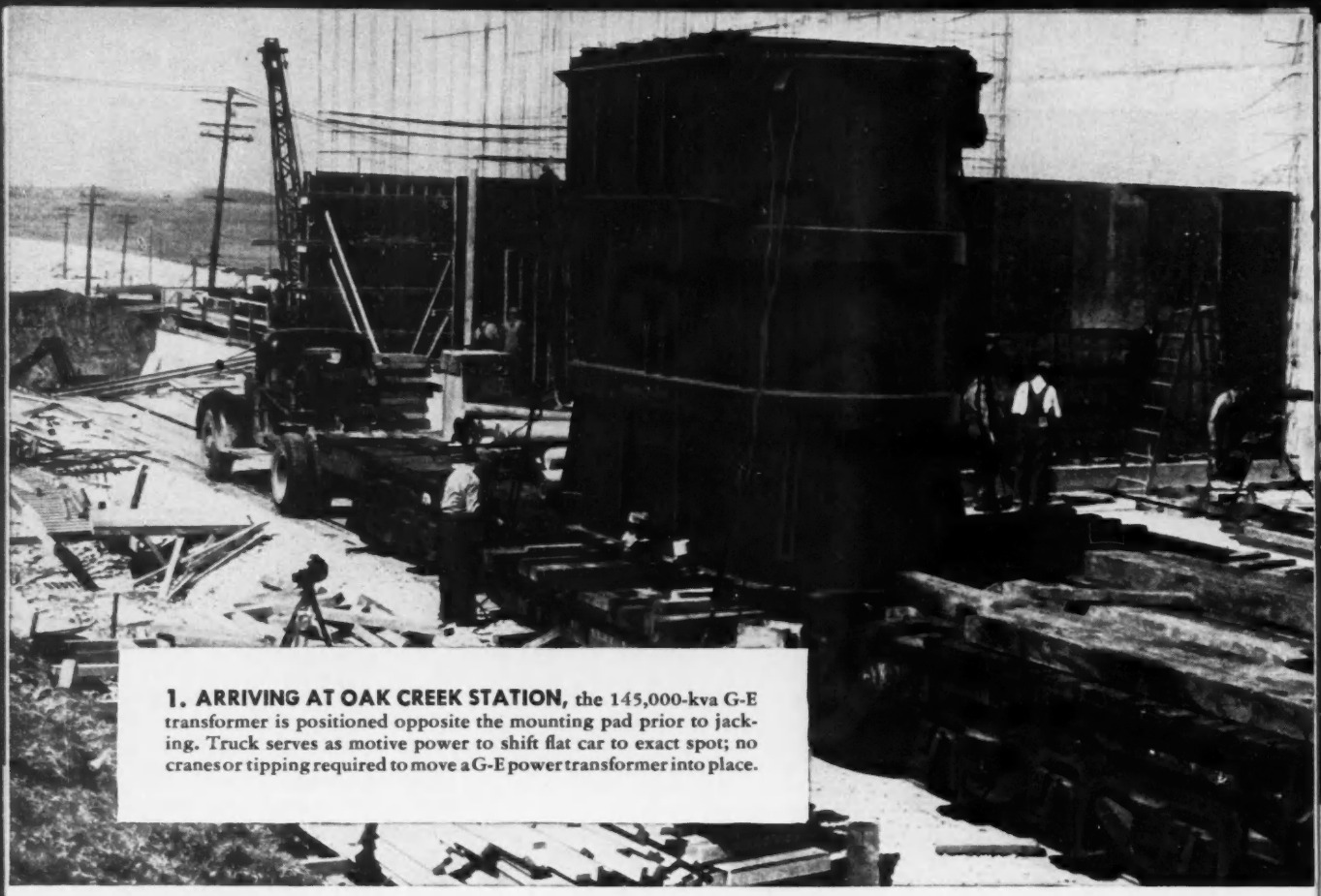
ORIENTING GUIDES assure proper alignment of control element in receptacle, permit replacement without reorientation.



OPERATING LEVEL can be easily adjusted in field or shop by turning slotted screw accessible through protective casing.

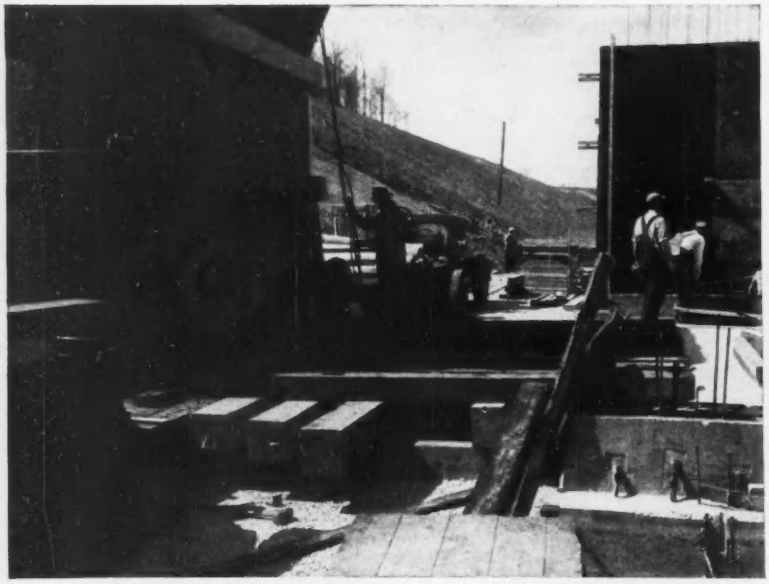


ETCHED CIRCUITS and dip-soldering assure positive electrical connections and permit easy replacement of components.



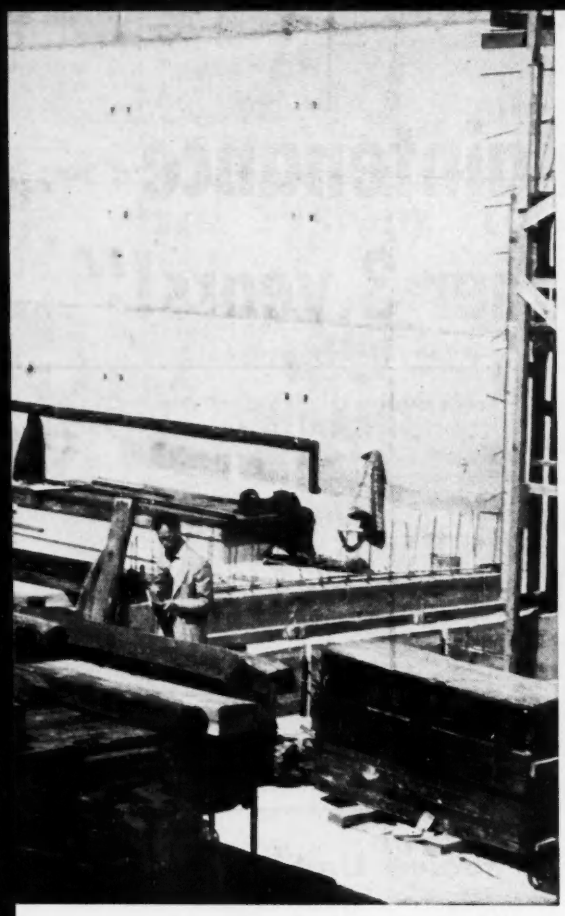
1. ARRIVING AT OAK CREEK STATION, the 145,000-kva G-E transformer is positioned opposite the mounting pad prior to jacking. Truck serves as motive power to shift flat car to exact spot; no cranes or tipping required to move a G-E power transformer into place.

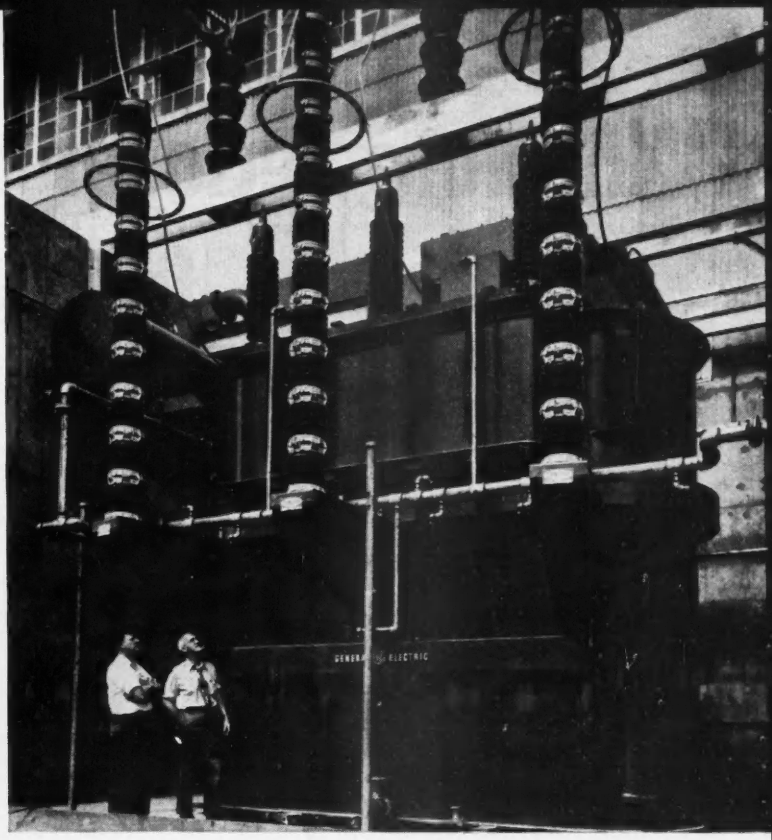
UPRIGHT SHIPMENT SPEEDS



2. AFTER JACKING the unit is ready to be moved to the pad. Next step is to put wooden rollers in place. Total time required for jacking and positioning skids and rollers was 2½ days. Only truck winches were needed.

3. BLOCKS ATTACHED and ready to start rolling. Workman checks position of rollers before starting the shift from flat car to pad. While nearness of siding to pad helped reduce time, upright shipment simplifies any installation.





4. UNIT IN PLACE with bushings, cooler connections, and arresters installed. Only 4 operations were necessary to complete the installation of this 145,000-kva G-E transformer. Upright shipment makes the job easier!

G-E TRANSFORMER INSTALLATION

145,000-kva units for WEPCO shipped upright in one-piece tanks for easier, faster installation—at less cost

One of two General Electric 145,000-kva forced-oil water-cooled power transformers is shown being installed at the new Oak Creek station of Wisconsin Electric Power Company. These units are step-up transformers applied to raise generator voltage from 13,200 volts to 138,000 Gr Y for high-voltage transmission.

Installation was faster due to G-E one-piece tank construction and upright shipment. Installation time ran as follows: Jacking, 2½ days; moving to pad, ½ day; installing bushings, 1 day; filling with oil, 6 hours.

Only 4 operations are required to install large G-E power transformers:

1—Slide off flat car onto pad—no tipping, no top tank-sections to assemble.

2—Install bushings, radiators, and accessories.

3—Fill with oil and connect oil preservation equipment.

4—Connect to line and energize.

Upright shipment saves time, money. Instead of arriving on its side, or in sections—which would require expensive tipping and assembly operations—most G-E transformers arrive upright . . . ready to slide off the flat car to the foundation. This means that G-E transformers can be installed faster and easier. Utilities report that upright shipment has saved them up to $1750 per unit in installation costs.

Why can G-E units be shipped upright? All G-E transformers have concentric windings. These windings have higher thermal, mechanical and electrical strength, yet are very compact. They permit transformers to be fitted into smaller tanks which can be shipped in the upright position.

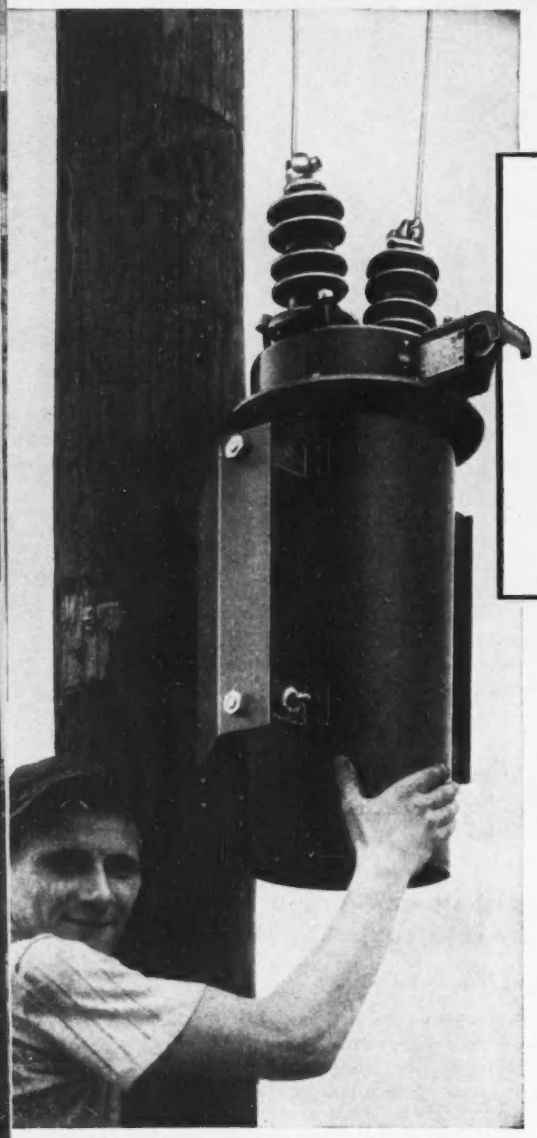
For full information about G-E power transformers, get in touch with your nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.

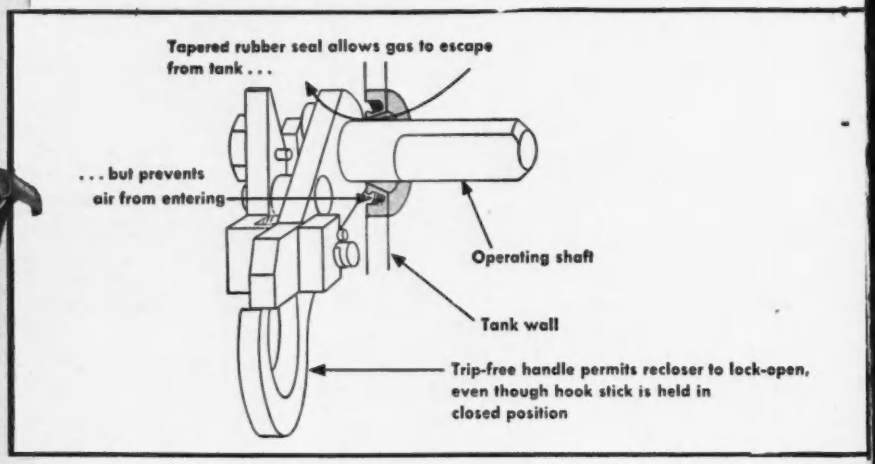
421-12

You can put your confidence in—

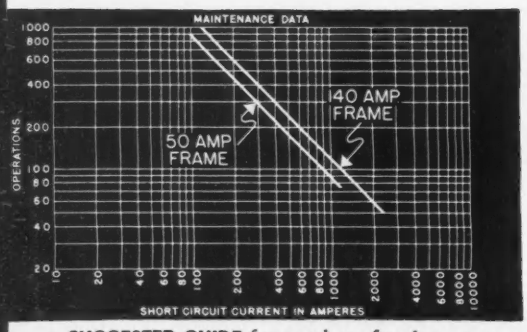
GENERAL ELECTRIC

"No more recloser maintenance for another 3 years!"




Tapered rubber seal allows gas to escape from tank . . .
. . . but prevents air from entering
Operating shaft
Tank wall
Trip-free handle permits recloser to lock-open, even though hook stick is held in closed position

G-E's VALVE SEAL (in diagram) keeps dust, moisture from recloser, allows interruption gases to escape. Recloser maintenance is reduced two-thirds.



SUGGESTED GUIDE for number of recloser operations before inspection of 50- or 140-amp unit is based on conservative laboratory tests. With experience, time interval of 3 years may be extended later.

G-E exclusive "Sealed Unit" on Type FR Automatic Recloser permits longer inspection intervals

For the first time in the history of oil circuit reclosers, it is now possible—with General Electric's exclusive sealed unit Type FR Recloser—to schedule inspection and maintenance *only every 3 years.* Your maintenance is thus reduced to about one-third the amount considered normal for all reclosers.

GE's one-way valve seal around the operating handle shaft allows use of inhibited oil now being shipped with reclosers up to 140 amp frame size. With inhibited oil, reclosers should be inspected after the number of operations recommended on the curve in the graph at the left. In the majority of cases, the number of operations will be less than shown on the graph, and the recloser can be left in operation for the full 3 years.

With GE's new sealed unit FR reclosers, you get—

- **Exclusive valve seal that keeps out moisture and dust, yet permits interruption gases to escape.**
- **Minimum maintenance—reduced two-thirds.**
- **An available recloser design, completely interchangeable with other makes—plus top G-E quality and materials developed over a half century of manufacturing high-voltage breakers and reclosing devices.**

Sealed unit Type FR Automatic Reclosers come in single-phase FR-1 model and three-phase FR-3, continuous current of 5 to 140 amps, interrupting capacity of 125 to 2500 amps at 2400 to 14,400 volts. For details, write for bulletin, GEA-5961. General Electric Company, Schenectady 5, N. Y. 872-7

You can put your confidence in—

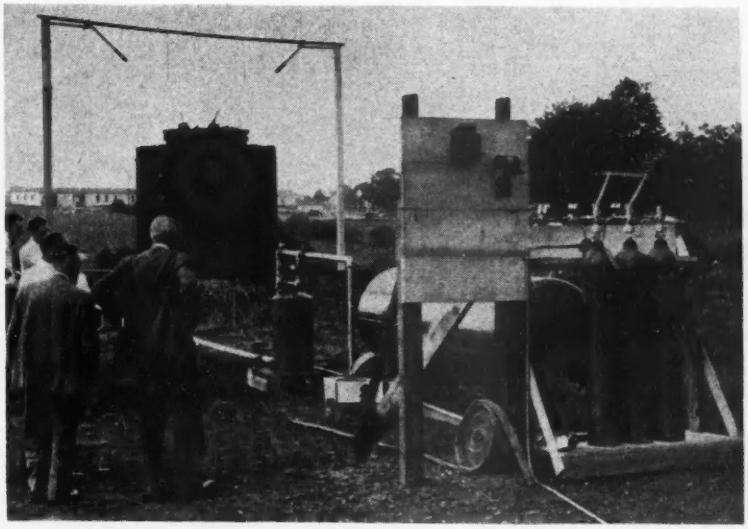
GENERAL ELECTRIC

Fire System Protects Waterless Station

An automatic air-foam fire extinguishing system for protection of outdoor transformers where no water supply is available has been developed jointly by Pyrene Manufacturing Co and Grinnell Co, Inc. Successful extinguishing tests on a de-energized transformer were made at Philadelphia Electric Co's property in Plymouth Meeting, Pa.

Transformers must be de-energized when using the system because air-foam is a conductor of electricity. Automatic switching before the extinguishing system operates overcomes this danger.

Basic difference between this air-foam system and others is that water is supplied from a 500-gal storage tank pressurized by three 220-cu ft, 2,200-psi, nitrogen cylinders. A pressure regulating valve connected between the tank and cylinders reduces the tank pressure to 145 lb. When the system is not in use, cylinders are closed and the storage tank is not pressurized.



FIRE EXTINGUISHING SYSTEM is actuated by either of two heat detectors located directly above transformer. Spray heads, also above transformers, aspirate air into foam solution

Operation . . . At the outbreak of a transformer fire, Fenwal detectors, which are set to operate at 140 F, close a circuit that opens the discharge heads on nitrogen cylinders. Pressure is released into the water tank forcing water out. Water flows to a proportioning tank containing 3% low-expansion protein foam compound, which is pressurized by the water.

Foam compound is then metered into the main water stream and the solution is transmitted through fixed piping to two foam-maker spray heads located above the transformer. Spray heads aspirate air into the solution.

Foam is discharged from each spray head at approximately 300 gpm or a total of 3,600 gal. This is sufficient to cover a 500-sq ft bay area with a 12-in. blanket of foam. Spray heads provide a discharge pattern for wide coverage and fast extinguishment.

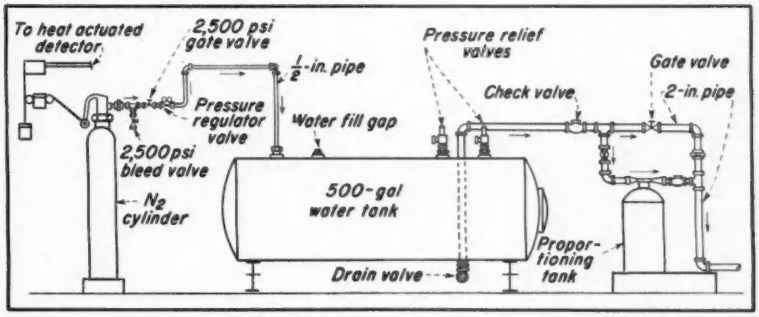
Fire extinguishing tests were performed on a transformer used by Philadelphia Electric to train fire operating personnel. The transformer is 8 ft in diam, and 12 ft high, with bushings removed. It has 12 radial radiator fins, two of which are ruptured within the oil level in the transformer so that oil is discharged during test. There is an 18-in. opening in the transformer top.

The transformer is mounted on a specially constructed "I" beam base, which sets on a 20-ft diam crushed stone dike. Unconventional base beams slowed extinguishing time because an 8-in. depth of foam was required to extinguish fire.

Capacity of the transformer is 2,000 gal. For tests, it was filled with 1,200 gal of water and 800 gal of No. 2 fuel oil. This oil was used instead of transformer oil because of its lower cost and lower flash point. A pressurized water line was connected to the bottom of the transformer to discharge oil from the top.

Two tests were conducted. The first involved spilling 150 gal of oil from the transformer, priming the oil with gasoline, igniting, and allowing automatic operation to follow. After 20 sec, the transformer was enveloped in fire and the system began to operate. Water line to the transformer base was shut, however, oil continued to spill.

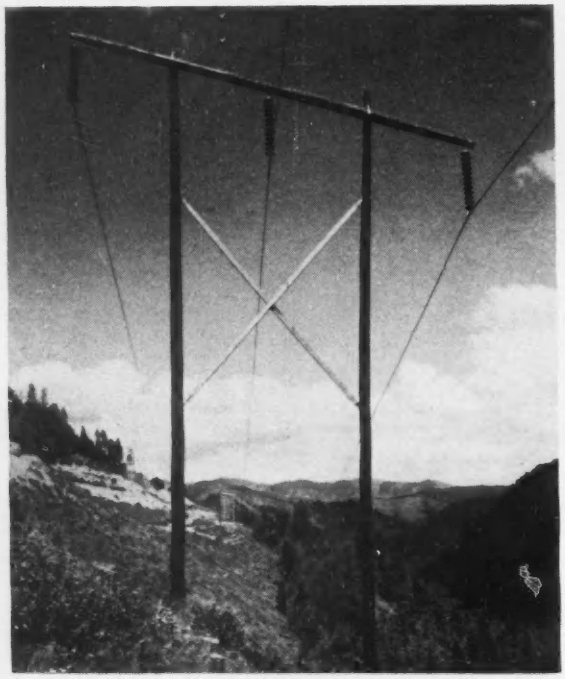
Four sec after fire extinguishing



WATER TANK pressurized from nitrogen cylinders supplies water for making foam. Tank is only under pressure when cylinder heads are opened by heat detector operation.

system began to operate water discharged from the spray nozzles. Twenty-four sec later foam began discharging. Two and one-half min after ignition fire was extinguished in areas other than the internal section of the base. Complete extinguishment was effected in 4½ min following ignition. Discharge continued for 2⅓ min.

Following removal of the foam blanket, another 150 gal of oil was spilled out of the transformer top, increasing the quantity of oil in the base. In this second test fire was allowed a 1-min pre-burn before the system was operated manually. Water began discharging in 4 sec, foam in another 20 sec. The fire was under control in 2½ min after ignition and completely extinguished in 2¾ min. Total discharge time was 6⅓ min.



Save Pole Height By Sloping Crossarms

GLEN R. GEORGE, Construction Engineer, Washington Water Power Co, Spokane, Wash.

Spar arms framed in a sloping position meant quite a saving in pole height for Washington Water Power Co when its 230-kv line from Spokane to Cabinet Gorge hydro plant was built. This line passes through mountainous terrain, but no mechanical difficulties were met in building the H-frame structures in this manner.

Sloping of 40-ft spar arms on structures set on side hills was limited to a maximum 5-ft difference in height between poles. Required ground clearances also governed amount of slope.

SLOPING SPAR ARMS are novel feature of 230-kv line built through eastern Washington and northern Idaho. Saving of pole height in mountainous terrain resulted from sloping of arms

Meter Cutoff Simplifies Chart Removal Schedule

F. C. HUSH, Meter Supervisor, Consumers Public Power District, Columbus, Nebr.

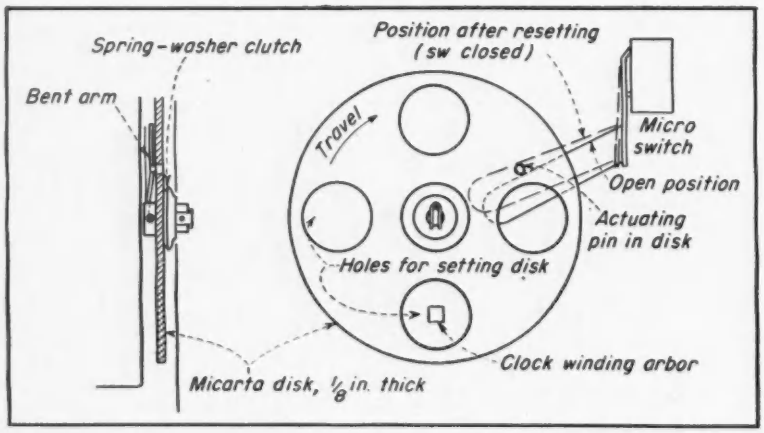
An automatic cutoff added to a circular-chart recording voltmeter permits a 24-hour record without overlap. This eliminates scheduling trips to check instruments at an exact time. Considerable savings result.

The cutoff, designed by Consumers Public Power District, requires simple voltmeter modifications that include:

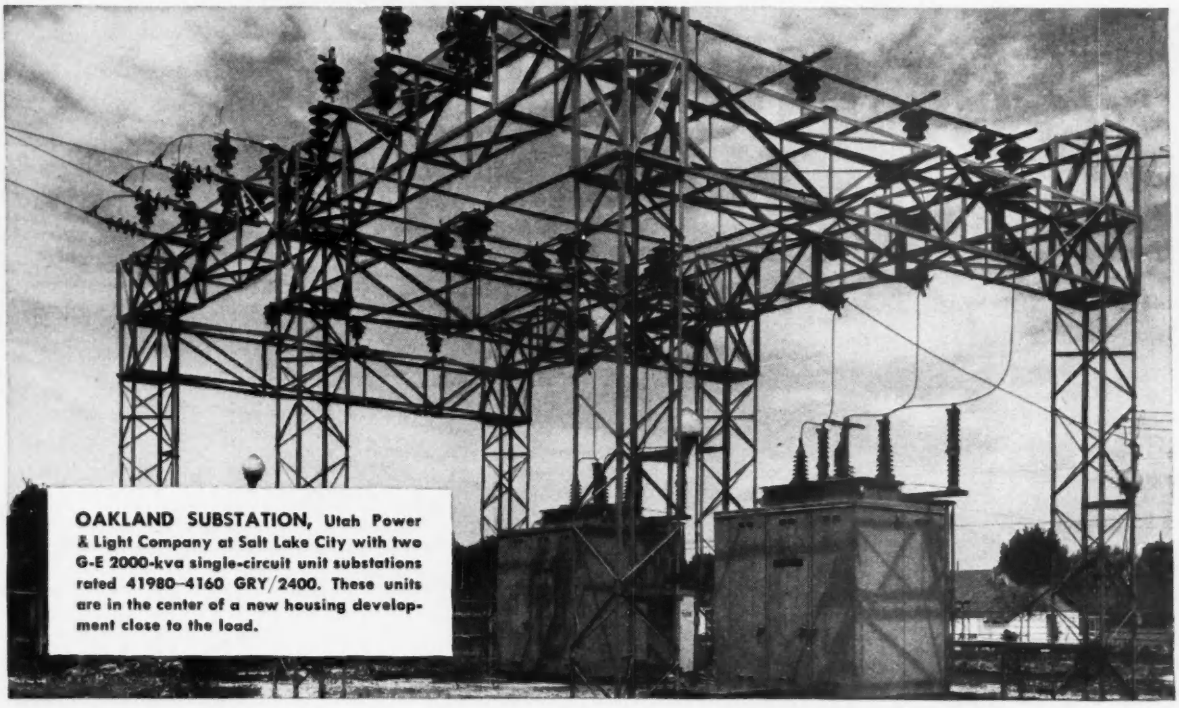
1. Providing a chart backing plate with a small actuating pin protruding from the back side and with holes for resetting the cutout, winding the clock, and positioning the plate.

2. Installing a micro switch that has a specially bent operating arm. The upper edge of the thin-section arm is bent forward to engage the actuating pin. When the arm is pressed back, for reset, the arm's slope provides pin clearance.

In operation, a chart is placed and the operating arm is depressed. This permits the switch to close, which energizes the meter. After 24 hours, the pin in the slowly rotating plate engages the switch arm, opening the meter circuit.



METER MODIFICATIONS are made in instrument shop. Micarda disc replaces former plate



OAKLAND SUBSTATION, Utah Power & Light Company at Salt Lake City with two G-E 2000-kva single-circuit unit substations rated 41980–4160 GRY/2400. These units are in the center of a new housing development close to the load.

When load doubles in new housing area . . .

Utah Power & Light Company meets demand with G-E single-circuit unit substations

2000-kva units conserve space, permit shorter lines, reduce installation, maintenance costs

To meet the tremendously increased power demand that has developed in Salt Lake City since World War II, Utah Power & Light Company has now standardized on the use of single-circuit unit substations. Ten years ago there were only three unit subs in the area . . . now there are twenty.

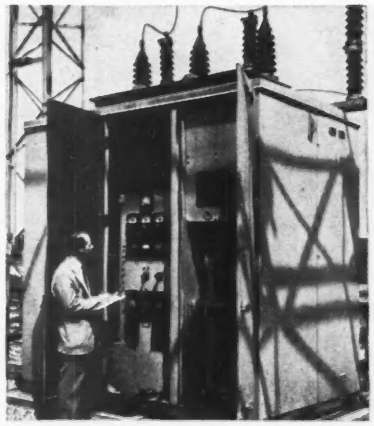
Load-growth problems simplified with G-E single-circuit unit substations because they incorporate transformer, vertical lift magne-blast air circuit breaker, load-ratio-control with voltage regulation, meters and other necessary instruments in a single, fully co-ordinated enclosure. They permit:

- Lower land cost because they require minimum space.
- Shorter lines because they can be located close to load.
- High re-use value because units may be easily shifted if the load changes or is seasonal.

Low and predictable installed cost, because there is nothing else to buy . . . nothing to overlook. Purchasing is simplified . . . only one specification, one purchase transaction. Repeat orders can be placed without further engineering or specification writing.

Standard ratings. G-E integral type unit substations are furnished in ratings from 12 to 66 kv incoming voltage. They have their widest application in areas of light-load-density where a single 2.5- or 4.33-kv feeder with 1000 to 3000 kva of load is to be served, or in the 15-kv class for loads of 1000 to 5000 kva.

If you are faced with load growth problems, investigate G-E single-circuit integral unit substations. For full information get in touch with your nearest G-E Sales Representative, or write General Electric Company, Section 422-7, Schenectady 5, N. Y.



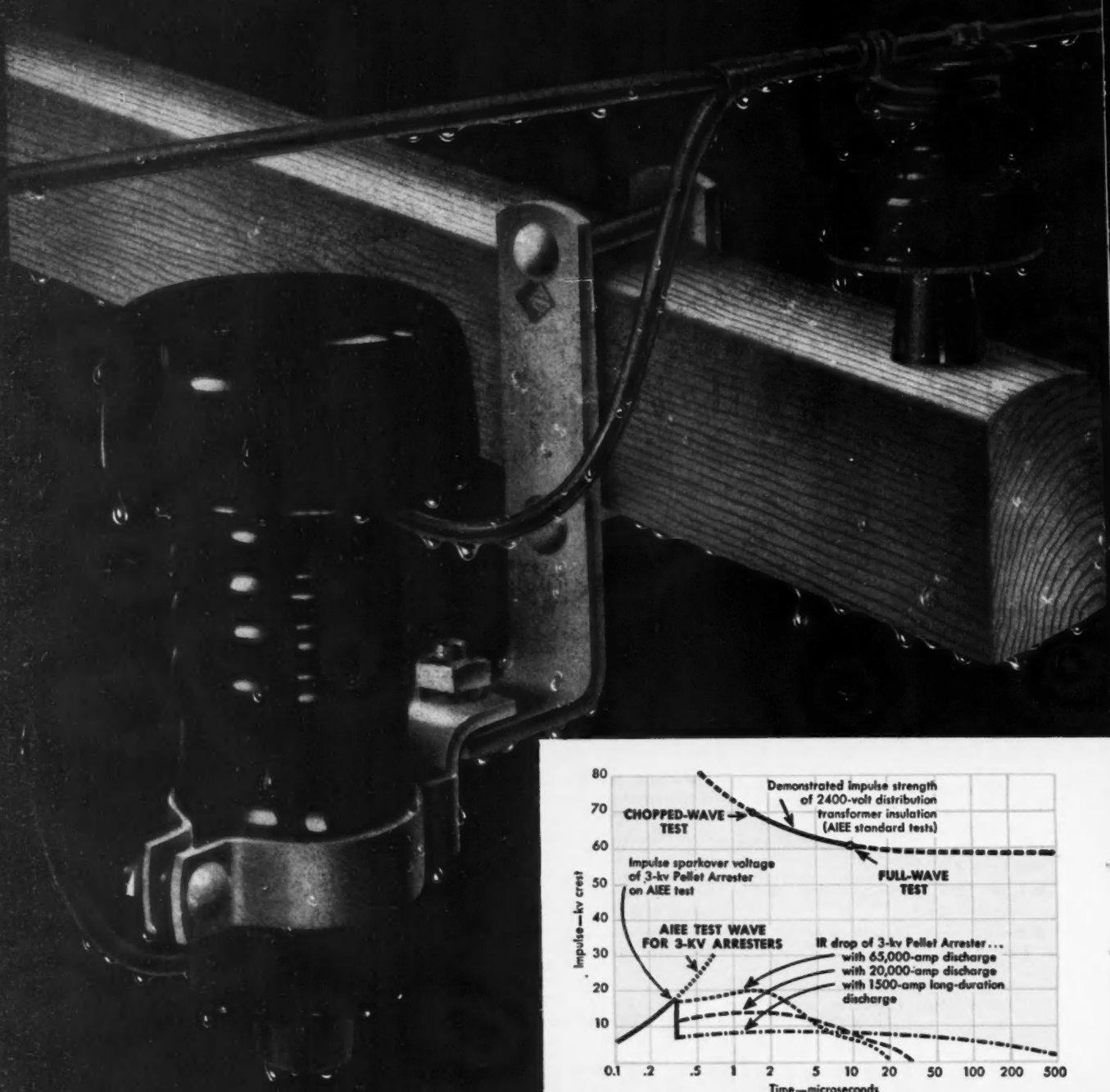
DWANE G. JENSEN, Substation Supervisor, Salt Lake City Division, Utah Power & Light Company, inspects one of the new G-E single-circuit substations.

You can put your confidence in—

GENERAL ELECTRIC

PELLET ARRESTERS

no other distribution arrester protects



Graph from actual oscillograms demonstrates unequalled margin of safety —resulting from exceptionally low sparkover voltage and low IR drop.

so well . . . because no other arrester

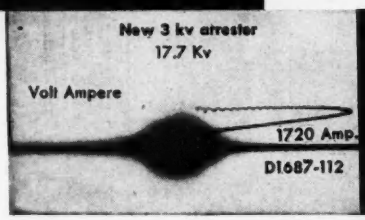
- **has such low impulse sparkover and low IR drop**
- **retains its protective characteristics for so long**
- **is so completely self-protecting against moisture**
- **is so universally applicable on all systems**

General Electric pellet lightning arresters assure the most complete and durable system protection available . . . enabling a new high in continuity of electrical service—at a new low in operating costs and maintenance of distribution systems. Whether lightning currents are high or low, with durations long or short, no other distribution arrester holds voltages to such low levels. And because it's a valve-type, the pellet arrester can be applied universally—on urban, rural or industrial distribution systems—no worry about available or future short-circuit currents, expulsion arc-flames, or high follow currents blowing fuses and depleting the arrester's life.

Remember also, pellet arresters are backed by *35,000,000 arrester-years of proved operation*—a service record unapproached by any other arrester. For complete information on G-E pellet arresters, available in ratings 1 kv through 15 kv, contact any G-E apparatus sales office, agent or distributor, or write for Bulletin GEA-2975. Address Section 432-4, General Electric Company, Schenectady 5, New York.

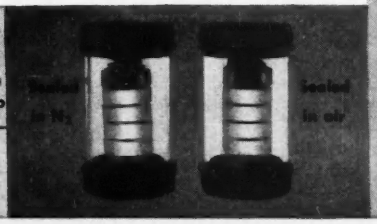
You can put your confidence in—

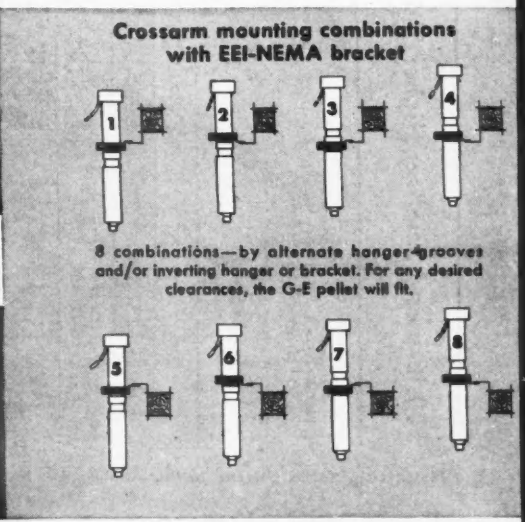
GENERAL ELECTRIC



Oscillograms of performance of new and old arresters prove that the excellent protection by pellet arresters stays excellent.

Pellets unaffected by service moisture. Nitrogen-filled gaps exclude corrosive moisture—proved by life tests (below).





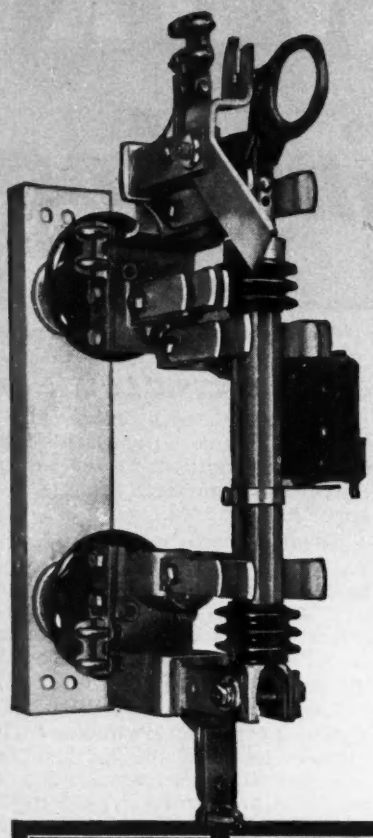
Standard Ratings for Transformers Three-Phase, Distribution, Overhead Type

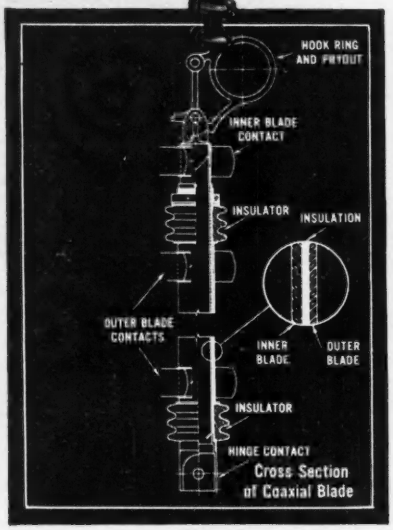
500 Kva and Smaller; Higher Voltage—67 kv and Below; Low Voltage—15 kv and Below

Preferred Nominal System Voltage	Transformer High-Voltage Rating	High-Voltage Taps		Standard Kva Ratings for Low-Voltage Ratings of: (a)				
		Above	Below	2387/193	240 (b) or 480	240x480 (b)	2,400 or 4,160Y/2,400 or 4,800	12,470Y/7,200 or 13,200Y/7,620
2,400	2,400	None None 2-2½%	None 4-2½% 2-2½%	9-75 112½-500	9-45 —— ——	75 —— 112½-500	—— —— ——	—— —— ——
2,400/4,160Y	4,160Y/2,400	None None	None 4-2½%	9-75 112½-500	—— ——	—— ——	—— ——	—— ——
	4,160Y	None 2-2½%	None 2-2½%	—— ——	9-45 ——	75 112½-500	—— ——	—— ——
	4,160	1-5% None None	1-5% 2-5% 4-2½%	—— 9-75 112½-500	9-45 ——	75 ——	—— ——	—— ——
4,800	4,800	None None 2-2½%	None 4-2½% 2-2½%	9-75 150, 300, 500	9-45 ——	75 ——	—— ——	—— ——
4,800/8,320Y	8,320Y/4,800	None None	None 4-2½%	9-75 150, 300, 500	—— ——	—— ——	—— ——	—— ——
	8,320Y	None 2-2½%	None 2-2½%	—— ——	9-45 ——	75 150, 300, 500	—— ——	—— ——
7,200	7,200	None None 1-5% 2-2½%	2-5% 4-2½% 1-5% 2-2½%	9-75 112½-500 ——	—— 9-45 ——	—— 75 112½-500	—— —— ——	—— —— ——
12,000	12,000	None None 1-5% 2-2½%	2-5% 4-2½% 1-5% 2-2½%	15-75 112½-500 ——	—— 15-45 ——	—— 75 112½-500	—— —— 150, 300, 500	—— —— ——
7,200/12,470Y	12,470Y/7,200	None None	2-5% 4-2½%	15-75 112½-500	—— ——	—— ——	—— ——	—— ——
	12,470Y	1-5% 2-2½%	1-5% 2-2½%	—— ——	15-45 ——	75 112½-500	—— ——	—— ——
7,620/13,200Y	13,200Y/7,620	1-5% 2-2½%	1-5% 2-2½%	15-75 112½-500	—— ——	—— ——	—— ——	—— ——
	13,200Y	1-5% 2-2½%	1-5% 2-2½%	—— ——	15-45 ——	75 112½-500	—— ——	—— ——
13,200	13,200	None 2-2½%	4-2½% 2-2½%	112½-500 ——	—— ——	—— 112½-500	—— 150, 300, 500	—— ——
14,400	13,800	14,400 14,400/14,100	13,800 13,500/13,200	15-75 112½-500	15-45 ——	75 112½-500	—— 150, 300, 500	—— ——
23,000	22,900	24,100/23,500	22,300/21,700	——	——	——	150, 300, 500	150, 300, 500
34,500	34,400	36,200/35,300	33,500/32,600	——	——	——	300, 500	300, 500
46,000	43,800	46,200/45,000	42,600/41,400	——	——	——	300, 500	300, 500
69,000	67,000	70,600/68,800	65,800/63,400	——	——	500	500	500

(a) STANDARD KVA RATINGS ARE: 9, 15, 30, 45, 75, 112½, 150, 225, 300, 500.
Kva ratings separated by a dash (–) indicate that all intervening standard ratings are included.
Kva ratings separated by commas indicate that only those listed are standard ratings.
(b) For transformers 150 kva and smaller with high-voltage ratings 15 kv and below, a 120-v reduced kva lighting tap shall be available.
Note: All windings are delta connected unless otherwise indicated.

Adapted from Edison Electric Institute Publication No. 53-1 and National Electrical Manufacturers Association Publication No. 114-1953





Reduce Space Requirements . . . . Lessen Possibility of Errors with DELTA-STAR'S *New*

"R-2K" REGULATOR BY-PASS SWITCH

A new concept eliminates the necessity of the typical two-blade construction and employs a "co-axial" blade in which one blade is inside the other. This provides a clean, sturdy, compact unit with a low reactance drop and reduced loss from skin effect or crowding of current to the surface of the conductor.

This switch combines three switches in one—a switch on either side of the regulator to disconnect it from the circuit and a third switch to act as a by-pass. In building all three switches as a unit, complete switching is simplified. Closing or opening is accomplished by one operation, thus reducing the possibility of error.

Contacts of the new "R-2K" By-Pass Switch are hard drawn copper with silver inlays backed up by beryllium copper springs and are the same as those on standard Delta-Star hook switches. Blades are equipped with a pryout device for ease of operation. These switches are guaranteed to carry full rated continuous current and corresponding short time current.

"R-2K" By-Pass Switches are available with or without interrupter in 400 and 600 ampere capacities at 7,500 and 15,000 volts. Write for complete information.

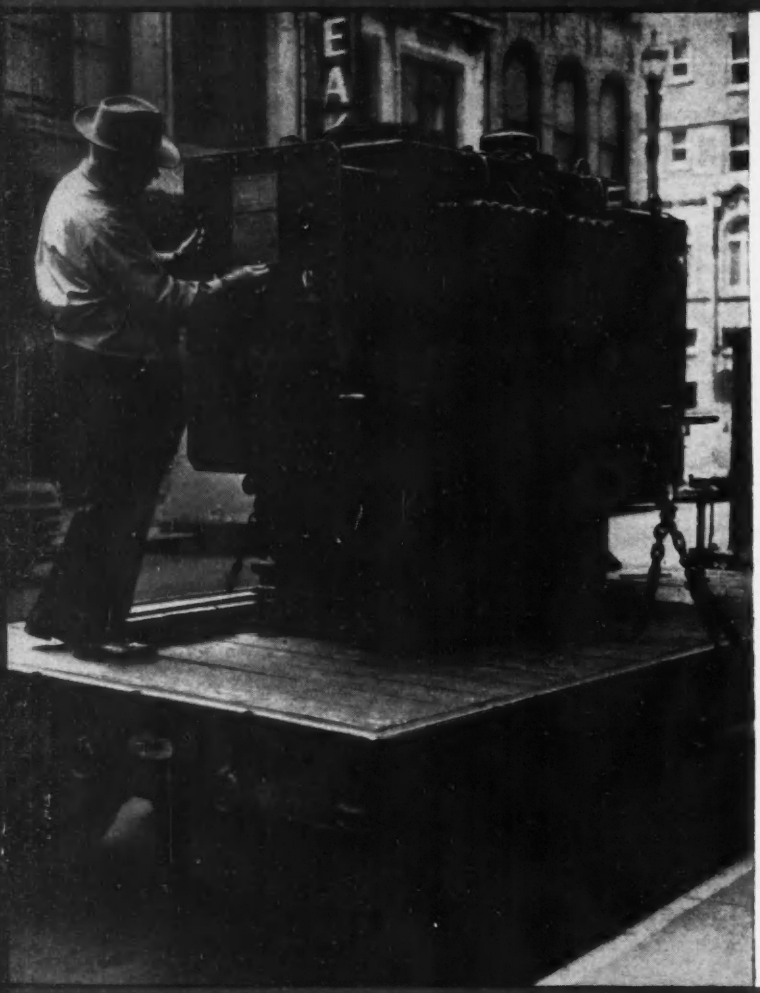
WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHING EQUIPMENT SPECIFY DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES

Allis-Chalmers

NETWORK Meets Growing Load



UNION ELECTRIC COMPANY faced both load and space problems in downtown St. Louis. Increasing loads required an addition to the company's network system. Heavy congestion made space hard to find.

So when space was located, the company planned wisely for future growth as well as for the present problem. The new vault was made double size. Holding a 500-kva Allis-Chalmers network transformer now, it leaves room for one more when future growth demands.

Careful attention to details during design and construction makes A-C transformers especially suited for this type of installation. Accessories are conveniently located. Protective coating against corrosion is applied to surfaces and tubes in the base area. Best possible sealing for bushings is provided by spiral wound metallic gaskets.

It will pay you to investigate all these details — as well as the compact low-loss design and high thermal capacity that help A-C network transformers meet severest load conditions. Get more facts from your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4186

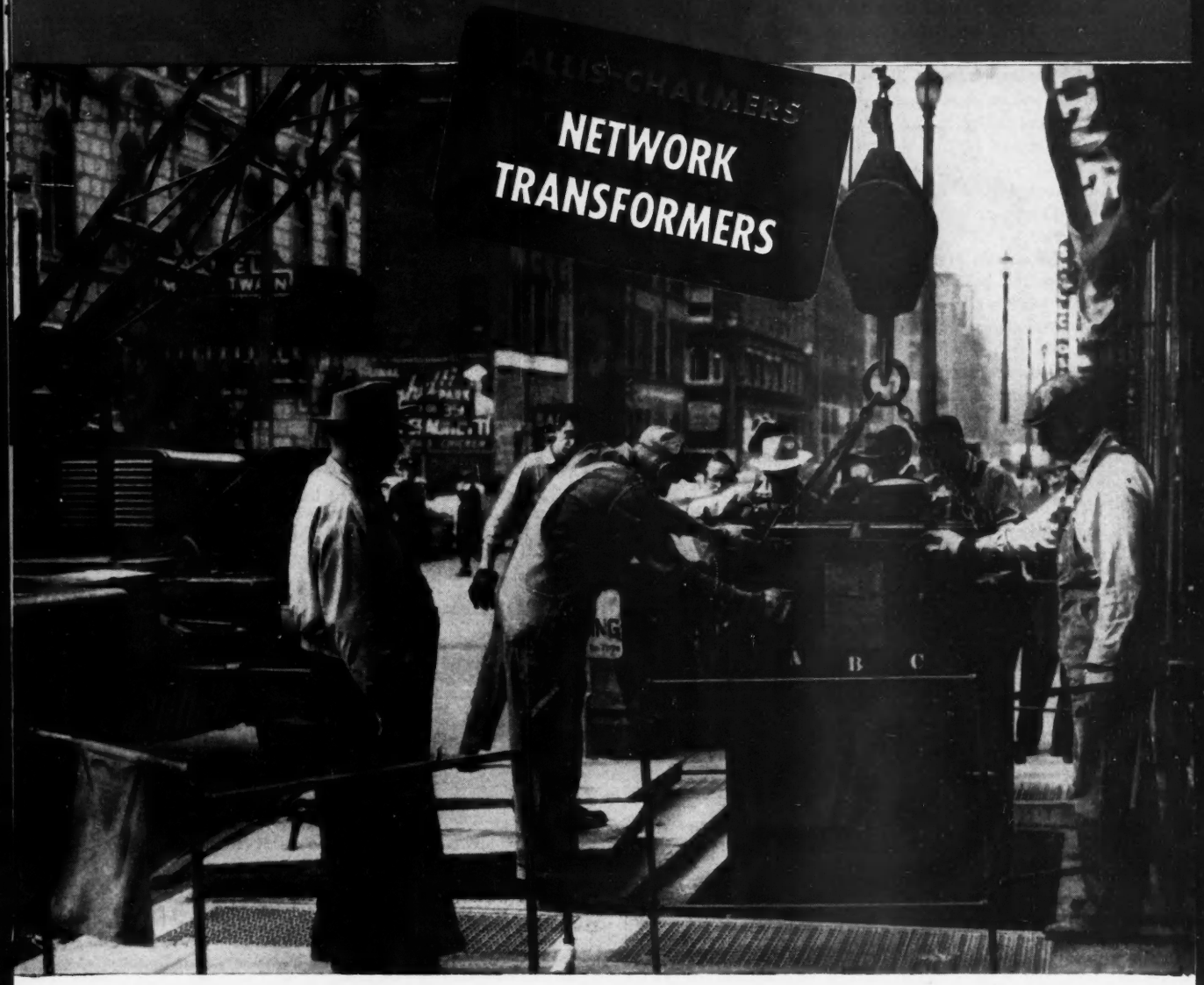
UNION ELECTRIC'S installation foreman, J. Edward Slocksick, checks nameplate information before new network transformer is installed near corner of Eighth and Pine Streets in the heart of St. Louis.

AREA SERVED includes one of the largest office buildings in St. Louis, the Arcade Building, where St. Louis Cardinals and many other amusement enterprises maintain offices. Building also contains many popular commercial shops. Left: crane picks transformer off truck.

ALLIS-

TRANSFORMER

in Downtown St. Louis



NETWORK TRANSFORMER was lowered into an entirely new vault, constructed double size to leave room for future system growth. Allis-Chalmers network transformers have been serving Union Electric for ten years. More than 1¼ million kva of these units are in operation throughout the country. Dependability — proved by outstanding service records — shows why Allis-Chalmers network transformers are ideally suited to crowded locations like this where service continuity is all-important.

CHALMERS

A-C ALLIS-CHALMERS

Meter Handling Methods Save Time of Five Men

E. H. TYSON, Superintendent of Meters, Pennsylvania Power & Light Co, Hazleton, Pa.

Slide boards, metal top tables, roller conveyors, and motor-driven belt conveyors are used in processing 350 to 500 single-phase meters per day in Pennsylvania Power & Light Co's central shop for meter testing and maintenance. These methods of handling meters have seven advantages:

1. Saves the time of five men in handling the shop output, based on experience with use of racks and carriers.

2. Contributes to increased shop output by permitting installation of additional handling equipment since the test shop was put in operation (EW, July 17, 1948, p66) without increasing space or personnel.

3. Dispenses with all meter storage racks and portable carriers.

4. Eliminates practically all handling time on the production line because each operator simply pushes completed work out of his way to the next operator.

5. Minimizes labor required at the unpacking and packing ends of the line.

6. Involves low investment cost.

7. Requires negligible maintenance.

Meters are received four in a carton from the districts. They are removed from cartons at the shop entrance, put in the production line for test and maintenance, then repacked four in a carton for storage.

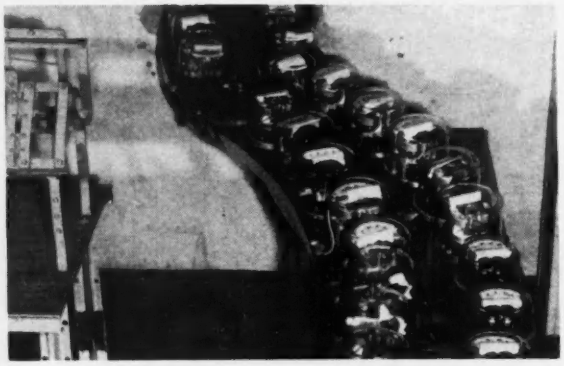
Cartons are palletized and handled by an electric carrier and stacker. Each pallet contains one size and type of meter. The only exception is to supply a small district with slow moving sizes or types.

Slide Boards . . . Sliding boards are in two forms for moving meters between cleaning, repairing, testing, and sealing operations. A "slide board" or long narrow table is used where operations are adjacent, each requiring a single mechanic. Such applications are between the "paint and touch-up room" and the preventive maintenance benches; also between the cover cleaning operation and the paint room. The boards have low guard flanges on each edge to prevent meters being pushed to the floor.

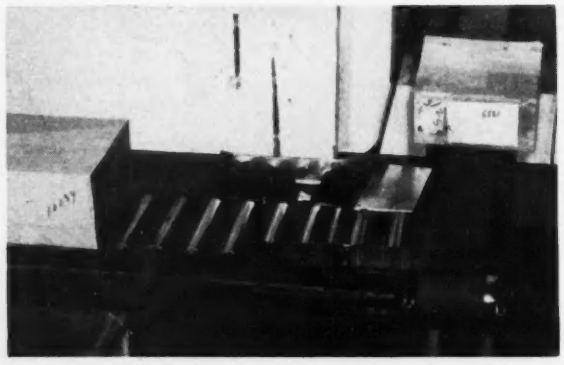
Another form of slide board is very wide and short. Here work is fed across the table from one operation to the next. Its large storage space allows for a minor difference in time between successive operations and allows working space for a variable number of operators on either side. The applications are between unpacking and unsealing operations, unsealing operations and "as found" test boards, preventive maintenance boards and "as left" test board, "as left" test board and time-run board, time-run board and sealing operation, and sealing and packing operations.

Roller conveyor and a short motor-driven belt are used in the packing operations. An operator lifts meters from the packing bench and places them in the carton on a belt-driven roller conveyor which is adjacent to the sealing bench. The carton top is the same height as the packing bench. Thus, cartons are filled and sealed without lifting them off the rollers. When packed cartons fill the roller conveyor, the motor is energized. Cartons roll to the end where they make a 90-deg turn onto a short belt conveyor and ride to a higher floor level. This is made necessary by building limitations. As each carton arrives at the belt terminal, the belt stops until the operator lifts the carton onto a stack or a pallet. The belt starts again automatically. The right-angle turn mechanism and the automatic stop were devised by meter dept supervisors.

STEEL TABLE TOPS are waxed to provide a suitable means for sliding meters from one operation to another. Table top at left carries meters between the unsealing operation and "as found" test boards



SLIDE BOARD is used to slide meters from paint room to preventive maintenance bench and from cover cleaning to paint room



ROLLER CONVEYOR and power belt carry meter cartons from packing and sealing benches to a higher floor level terminal

WHAM! Boeing B-47 *Stratojet* strikes at 600 m.p.h.

...tons of steel for tooling and jigs... supplied by CASTLE

TEN TONS OF BOMBS--deposited on target at better than 600 miles an hour--would produce such a devastating effect that it should definitely chill aggressive tendencies. That's the kind of a wallop the U. S. Air Force can deliver with the B-47 Stratojet, produced by Boeing Airplane Company, Wichita, Kansas. A. M. Castle & Co. is proud to be a factor in the production of this mighty bomber.

FOR PEACE OR DEFENSE--Castle is supplying steel--all types, kinds, sizes, and shapes--to thousands of producers from coast to coast. Some are large users, some are small--but each one is regarded as an important customer. And each one is given quick, friendly, cooperative service--on every order regardless of quantity. That's been Castle's policy for over 61 years.

IF YOU NEED STEEL--whatever the type, kind, size, shape, or quantity--phone A. M. Castle & Co. right now! No obligation, of course. Nine large, heavily stocked, completely equipped warehouses strategically located from Baltimore to Seattle--assure you of fast, nation-wide service.

CASTLE STEEL DISTRIBUTORS

EVERYTHING IN STEEL

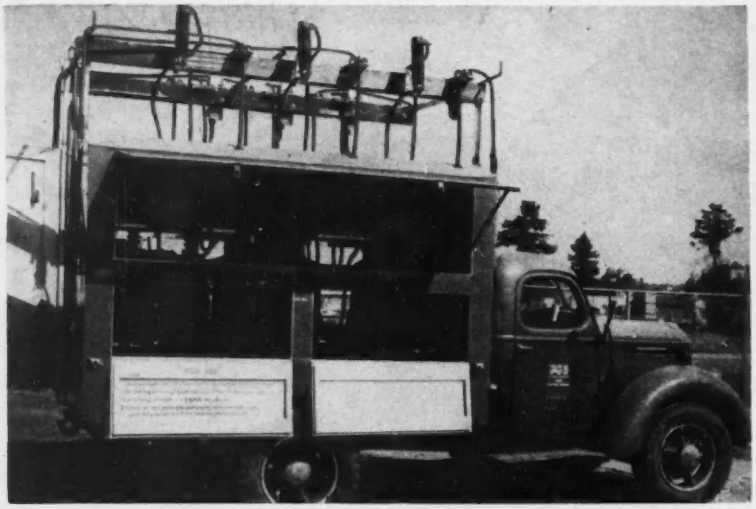
COLD FINISHED BARS • STAINLESS STEELS • HOT ROLLED BARS • TOOL STEELS • ALLOY STEELS • SHEETS PLATES • STRUCTURAL and many others in a large variety of sizes, grades, and finishes--for immediate delivery.

from coast to coast

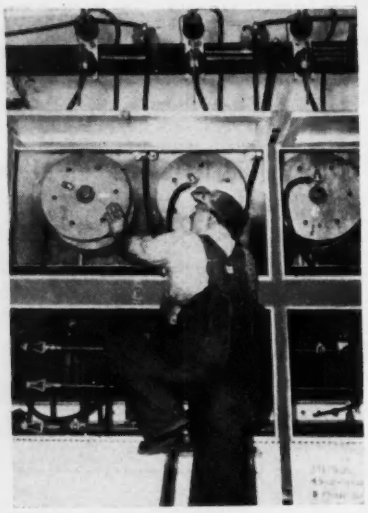
A. M. CASTLE & CO.

STEEL DISTRIBUTORS

BALTIMORE • CHICAGO • MILWAUKEE • ROCKFORD • KANSAS CITY • SEATTLE • SAN FRANCISCO • BERKELEY • LOS ANGELES



HIGH SIDE of portable 12.5/4-kv substation includes payout reels, primary bus and cutouts. Bus consists of conductors staggered vertically and hung between suspension-type insulators



PAYOUT REELS on low side have connectors which take cables from disconnects

Portable Substation Insures Service Continuity

Truck-mounted portable distribution substation designed and built by Public Utility District No. 1 of Clark County, Vancouver, Wash., has proven of considerable value in maintaining service during emergency conditions, routine transformer change-outs, and overhead line construction. PUD Supt. of Operations W. K. Bellows reports that the unit can be fully connected within 20 min after arrival at the site. Excluding cost of truck chassis and three transformers, substation was built by PUD personnel on spare-time basis for about $800.

Unit consists of three, two-bushing, 100-kva, 12/4-kv transformers, buses on high and low side, fuse cutouts and disconnect switches; and novel pay-out reels for making connections to both 12.5-kv and 4-kv lines. Three-phase, four-wire connections are available on low side. All equipment is carried on 1½-ton truck chassis. Transformers are mounted in center of the chassis, with cutouts and disconnect switches mounted on wood crossarms supported by angle-iron frame. Transformers are installed or removed through center of the frame.

Insulated and treated wood reels are mounted above and outboard of buses for safe and easy access. Three reels on high side and four on low side hold sufficient lengths of 15-kv and 5-kv cable, respectively, for ease in making connections. Free ends of cables are taken out through holes in top of substation to overhead lines.

Cables ride in roller guides at all angle points to provide protection against abrasion and for ease in paying out. Fixed end of cable terminates in cable connector set in side of reel. Locknuts hold reels stationary after cables have been reeled out.

After truck chassis has been grounded and neutral of secondary bus is tapped to overhead line neutral, primary cables are run out and cable leads from cutouts are plugged into connectors on reels. Cutouts and transformer primaries are then connected to primary bus with U-bolt connectors. Transformer secondaries and line sides of switches are connected in similar fashion to bus secondaries. With cable from secondary reels pulled out to proper distance, cable leads from switches are connected to reels. Substation is energized and tapped into 4-kv lines after doors on substation are closed.

Doors may be locked if substation is to operate overnight. Warning lights are an additional safety measure.

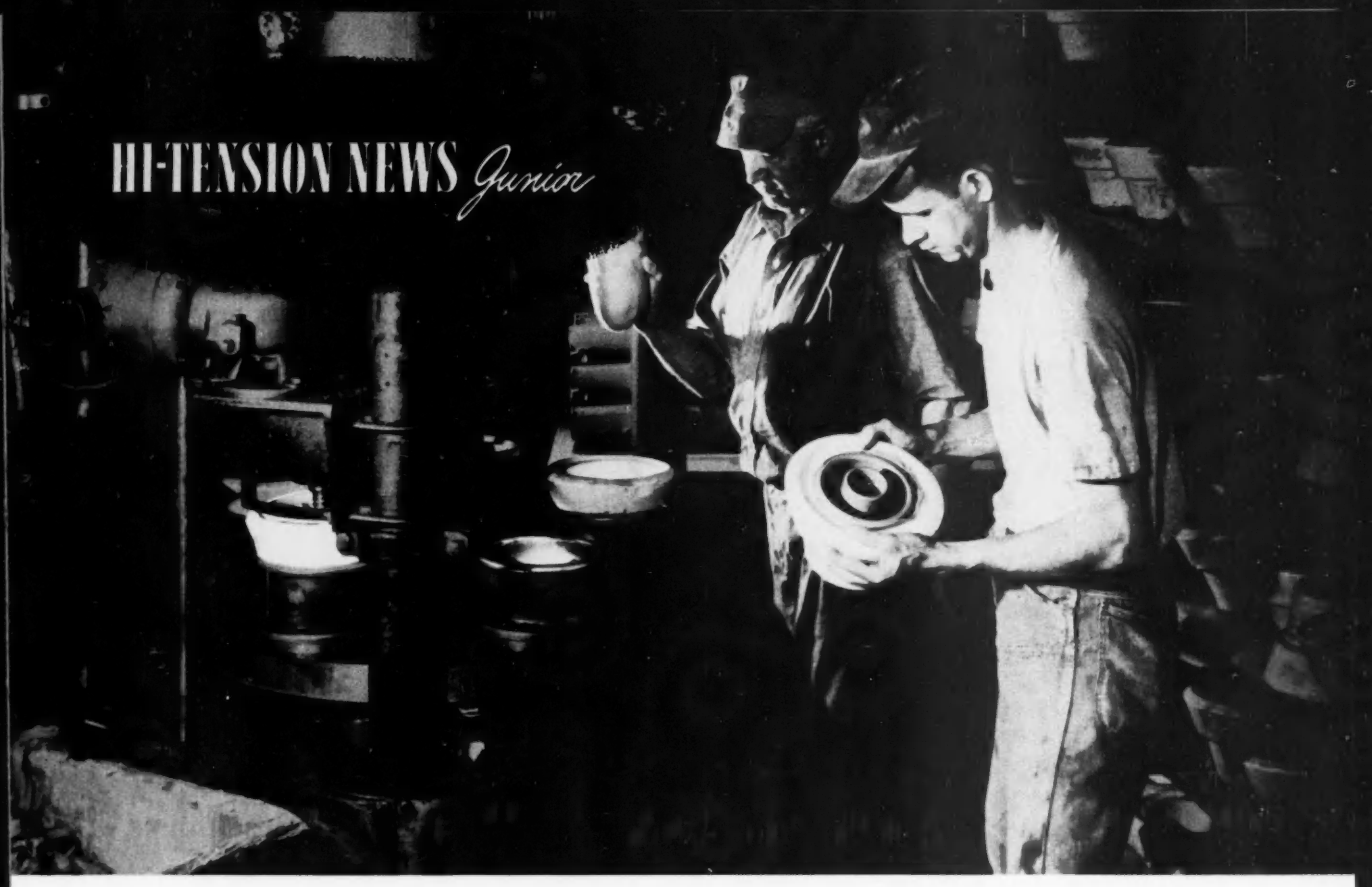
Wrong Lubricant Causes Failure of Exciter Coupling

Failure of a fast flexible type of coupling between exciter and main unit of a 60,000-kw turbogenerator at Phoenix Station of Arizona Public Service Co caused a 16-min outage throughout most of Phoenix in September. Failure was attributed to the application of an improper lubricant in the coupling.

Running at full capability at time of outage, the unit relayed out on undervoltage. Resultant shock to system caused interconnecting lines with Arizona Power Authority and Bureau of Reclamation to relay out. Remaining units at the station could not carry the load and the system partially shut down. However, through aid of interconnections, total service was restored within 20 min.

The 60,000-kw unit went into service in 1950 and has been operating continuously, except for annual inspection periods, since that time. Failed coupling had given no indication of trouble or loss of lubricant during more than three years of operation. About a week prior to failure, station operators noted a rise of temperature in exciter bearing adjacent to the coupling. However, bearing temperature returned to normal shortly

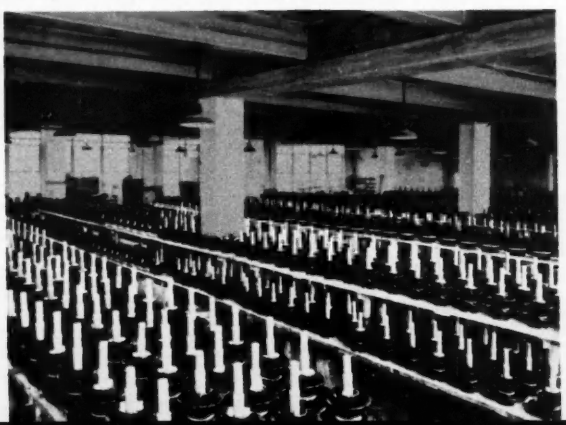
(*Continued on page* 159)



They're all just copies!

Take any O-B insulator -- the design and all its technical background are possessed by just one specimen you've never seen, couldn't use, wouldn't buy -- a bronze prototype in our factory vault. All you ever bought was a copy. The quality of the insulator is no better than the faithfulness of that copy!

Millions of accurate copies are the business of the O-B plant. A million copies of anything takes some doing, especially when you're copying more than just shape and have to include critical electrical values, mechanical strengths, and life expectancy in a basically "temperamental" material.



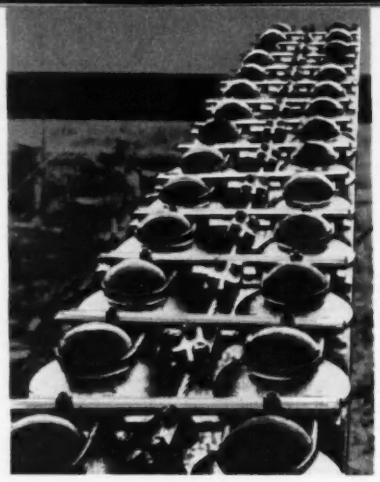
Part of the reason for the high reliability of O-B insulators is this manufacturing ability that most people just take for granted. And you're safe to go on doing it because *we don't take anything for granted.* From the day clay is dug out of a box car until the crate of insulators goes back into the car "professional pessimists" question material and processes, while others check, test, and inspect not big batches but the individual pieces.

No published standard specifies how carefully an insulator must be made -- this is one of the big differences between various products. But when you see the "O-B" monogram on an insulator you know a careful, capable manufacturer has done its honest best, and that "best" has made O-B the industry's CHOICE OF INSULATORS.

Ohio Brass

MANSFIELD, OHIO, U. S. A.

This O-B Deadend was *Under Construction* for nearly 40 years



In 1903, the Burrard Inlet Crossing of 2,868 feet was carried on 14 pairs of pintype insulators, yoked as shown, and placed in cantilever loading to suspend the span. Records do not disclose whether the original insulators were furnished by the predecessor of O-B, but in the intervening 20 years of operation, O-B frequently supplied replacements and engineering consultation.

Years before suspension insulators were used for the purpose, O-B cooperated in the design and insulation of long-span deadends using ingenious applications of switch or pintype insulators; followed by porcelain-jacketed wood strain units which we cataloged in 1914; and coming up to today when O-B design and insulation was applied to a great 10,656-foot span recently built in British Columbia. A lot of engineering background has been accumulated on this subject--background which many power companies have found mighty useful.

Sooner or later, most line designers encounter a long span and may wonder where they can get the deadend materials and the know-how. For most jobs, the materials are standard O-B items. For the big ones, we're ready with experience-backed recommendations. It's merely the natural process of going to the leading technical organization with your tough technical insulating problems. We don't know it all, but we've learned a lot and are equipped to run down specific questions in our laboratory. Check with O-B on your long-span requirements.

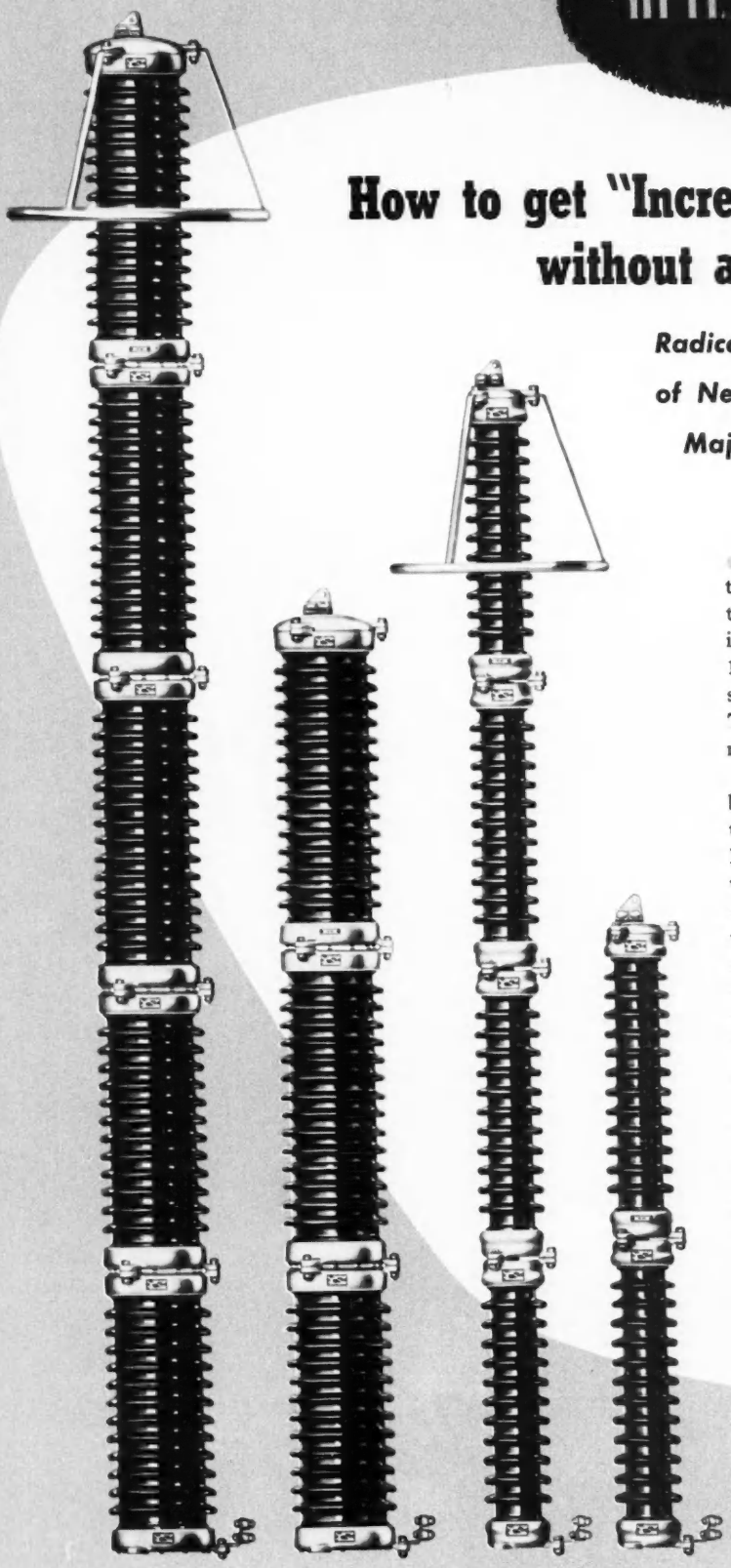
Newest and most spectacular span on the American Continent, crossing Kootenay Lake in British Columbia. Steel cables 1¼-inch diameter hang unsupported for 10,656 feet. Ultimate strengths run in the order of 300,000 pounds. Deadends are insulated with 25,000-pound O-B units linked by a load-dividing, lever-acting series of yokes that evenly distributes the tremendous strain and permits the insulators to work with generous safety factors.

4405-H

HI-TENSION NEWS *Junior*

How to get "Increased" Transformer BIL without a price penalty

Radically Lowered IR Discharge Voltage of New Thorex Type-MP Arrester Offers Major Improvement in Safety Factors



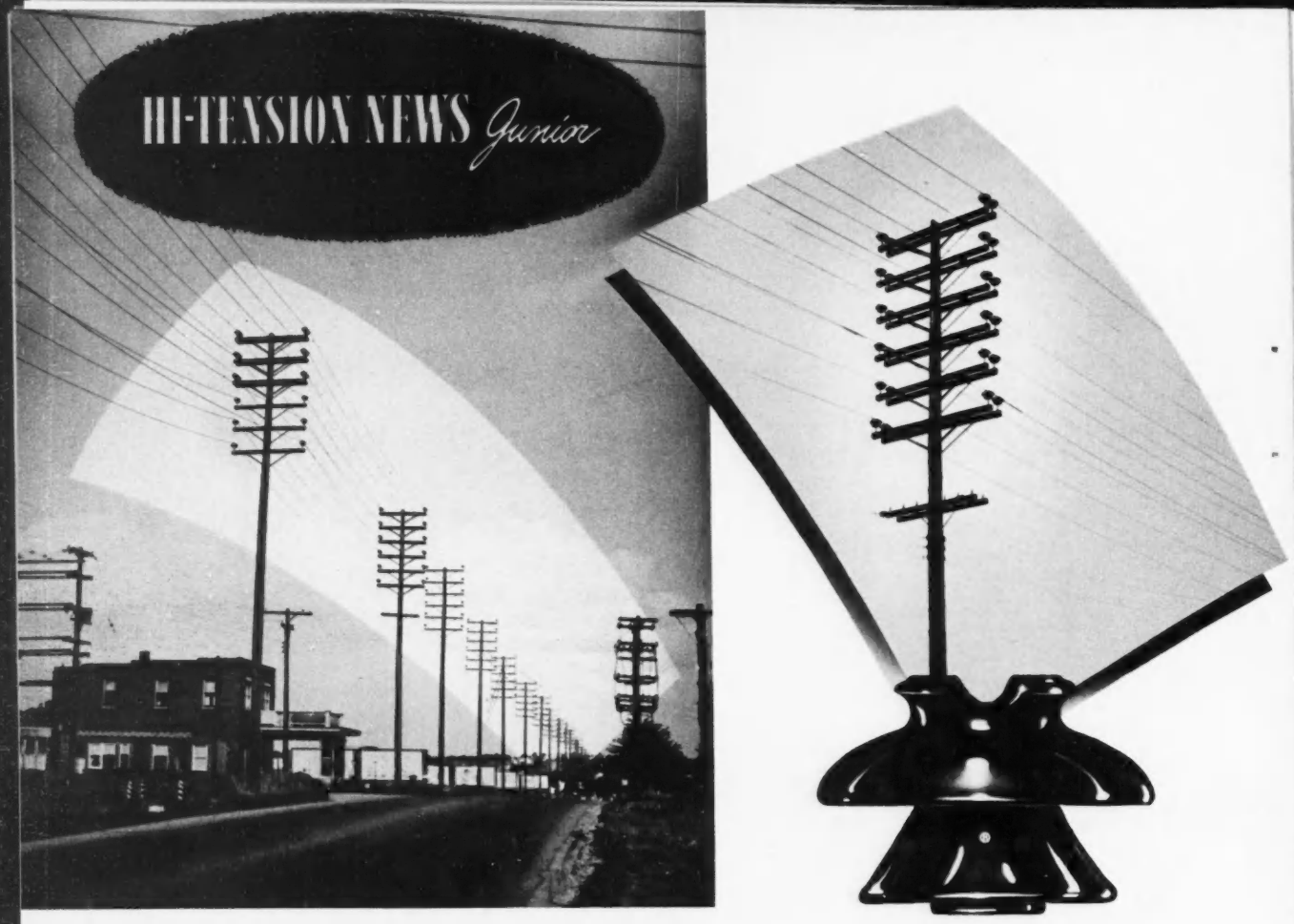
Without paying any premium, either for transformer insulation or lightning arrester price, you can now have the effect of increasing your present transformer BIL 13 to 18%. This added, and very tangible, safety factor is available with the new O-B Thorex Multi-Purpose (Type-MP) lightning arrester.

As a result of major improvements in both spark gap and valve block elements, the new Thorex Type-MP offers radically lowered maximum IR discharge voltage -- the point from which the kv protective margin of apparatus is measured. The wider margins possible with the new Thorex have exactly the same effect as adding to the BIL, except for the effect on your pocketbook! Increases of 13 to 18% of BIL, in some cases approximately double present safety factors.

The modern heavy-duty Thorex Type-MP has other protective features just as advanced as its improved protective margin. The whole story from 3 to beyond 300 kv is in the hands of your O-B District Representative. These details are well worth knowing before you specify your next arrester bank.

Ohio Brass

MANSFIELD, OHIO, U. S. A.



A dozen or two to the pole "Pyramids" the performance of these O-B Pintypes

Nearly 30 Years of Heavy Contamination and High Storm Exposure Have Passed by Uneventfully

When insulators are used a dozen or two to the pole, a service life of nearly 30 years on several miles of such a line builds up a lot of performance experience. Owners of the 22-kv line illustrated report no case of trouble from this large quantity of O-B pintypes. --And these insulators aren't loafing. Storm frequency is more than 40 days per year and, for the most part, the line operates in a dense industrial district somewhat "famous" for its polluted air, thereby creating a severe contamination problem. But, the insulators have taken all this in their stride.

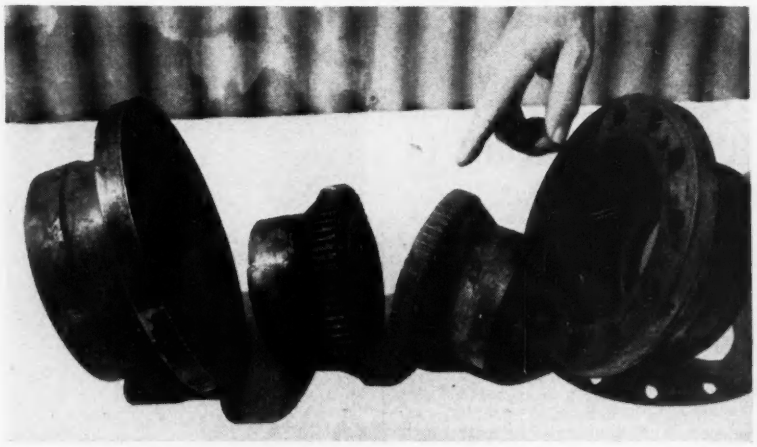
This is just one more "drop in the ocean of proof" attesting to the basic soundness of traditional pintype design -- as well as to the basic goodness of O-B's interpretation of that design into a rugged, reliable insulator. O-B pintypes have the happy faculty of staying off your mind. Specify them, and then you can proceed to *forget* them!

Ohio Brass

MANSFIELD, OHIO, U. S. A.

Wrong Lubricant

(*Continued from page* 154)



WORN TEETH on fast flexible type of coupling for direct-connected exciter caused 16-min outage. Grease lubricant recommended at installation has been replaced by heavy gear oil

and rise was considered of no consequence.

Grease-type lubricant was recommended and used in the coupling at time of installation and subsequent lubrications. But examination after failure indicated lubricant had channeled away from coupling gear teeth. It is assumed that lack of lubrication plus mechanical stresses occasioned by system disturbances common during summer reasons in Arizona caused teeth to wear and deteriorate to point of failure. Damage to 60,000-kw unit other than to coupling consisted of slight wiping of babbitt on the exciter thrust bearing shoulder.

Failure of this type of coupling is rare in experience of Arizona Public Service. Fortunately, a replacement coupling was obtained from another utility in a neighboring state and the turbogenerator was returned to normal service within 15 hr. Replacement coupling was lubricated with a heavy gear oil (viscosity 137 at 210 deg.). This type of lubricant has been used on other similar couplings at Phoenix Station over a period of 23 years. During this time only two smaller couplings have had to be replaced, but not due to failures.

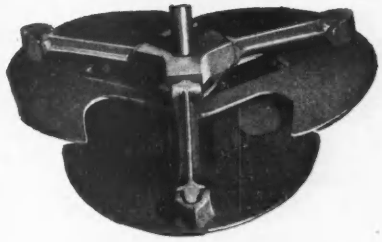
Armor Rods Speed Splicing

Neat strong splices on large all aluminum conductors are made quickly and easily by Detroit Edison Co with preformed armor rods. Full strength of the conductor is developed. Splices can be made on either energized conductors or on "cold" lines. Preformed armor rods are also used

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

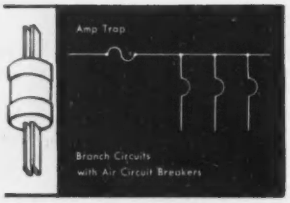
AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

Amp-trap®

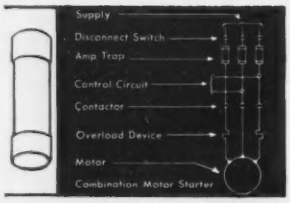
CHOPS **DANGEROUS SHORT-CIRCUITS DOWN TO SIZE**

Amp-trap with CIRCUIT-BREAKERS



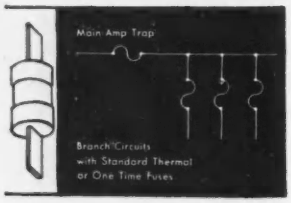
Amp-trap's lightning fast current limiting action makes it ideal for use in locations where the available short circuit current exceeds the circuit breaker's interrupting rating. It gives back-up, short-circuit protection to overload devices and clears a heavy short-circuit before the circuit breaker can open. Yet, the circuit breaker will open within its rating without blowing the Amp-trap.

Amp-trap with MOTOR CONTROLLERS



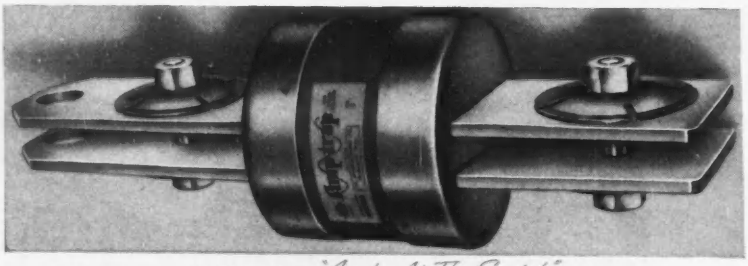
Amp-trap's small "let-through" current (low I^2t) gives positive protection to over current devices and contacts against high thermal or magnetic stress caused by super currents as high as 100,000 amperes R.M.S. at rated voltage. Amp-trap's operating characteristics limit stress on motor controllers, conductors, panel boards and load centers.

Amp-trap with PLUG-IN BUSWAY



Amp-trap's fast "chop-off" on high amperage short-circuit gives short-circuit protection to ordinary fuses and to isolate branch circuits without affecting feeder circuits or other branches supplied from the main busway. Actual tests on high short-circuit current have shown how Amp-trap amplifies plug-in busway momentary ratings by limiting magnetic and thermal stresses, and permits application of designs having limited withstanding ability on high powered installations.

Amp-trap is safe, efficient, economical short-circuit protection for electrical apparatus against large available short-circuit currents.



OUR 60th YEAR — FROM EDISON TO ELECTRONICS — Est. 1893

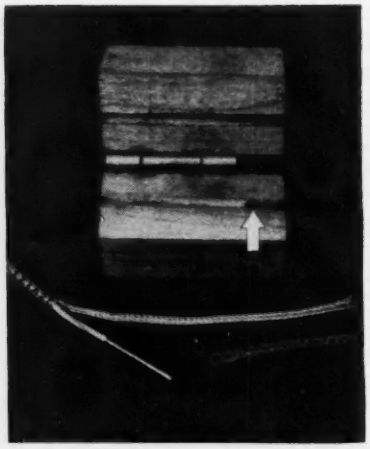
AMP-TRAP — *"Awake At The Switch"*

In Canada — Powerlite Devices, LTD.

THE **CHASE-SHAWMUT** CO.

370 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

to repair damaged conductors. The men illustrated are splicing a 350,000 cir mils conductor with preformed armor rods.



CUTTING BLADE is made from a No. 30 drill, ground to a sharp edge. Plastic cut from shielding is shown at lower right

Wire Stripper Saves 1½ Man-Hours a Day

A wire stripper used for splitting the plastic cover away from copper-tin braid on No. 18 and 20 shielded wire saves TEMCO Aircraft Corp 1½ manhours a day. In addition, an even cut, deep enough to slice the plastic but too shallow to endanger the shielding underneath results.

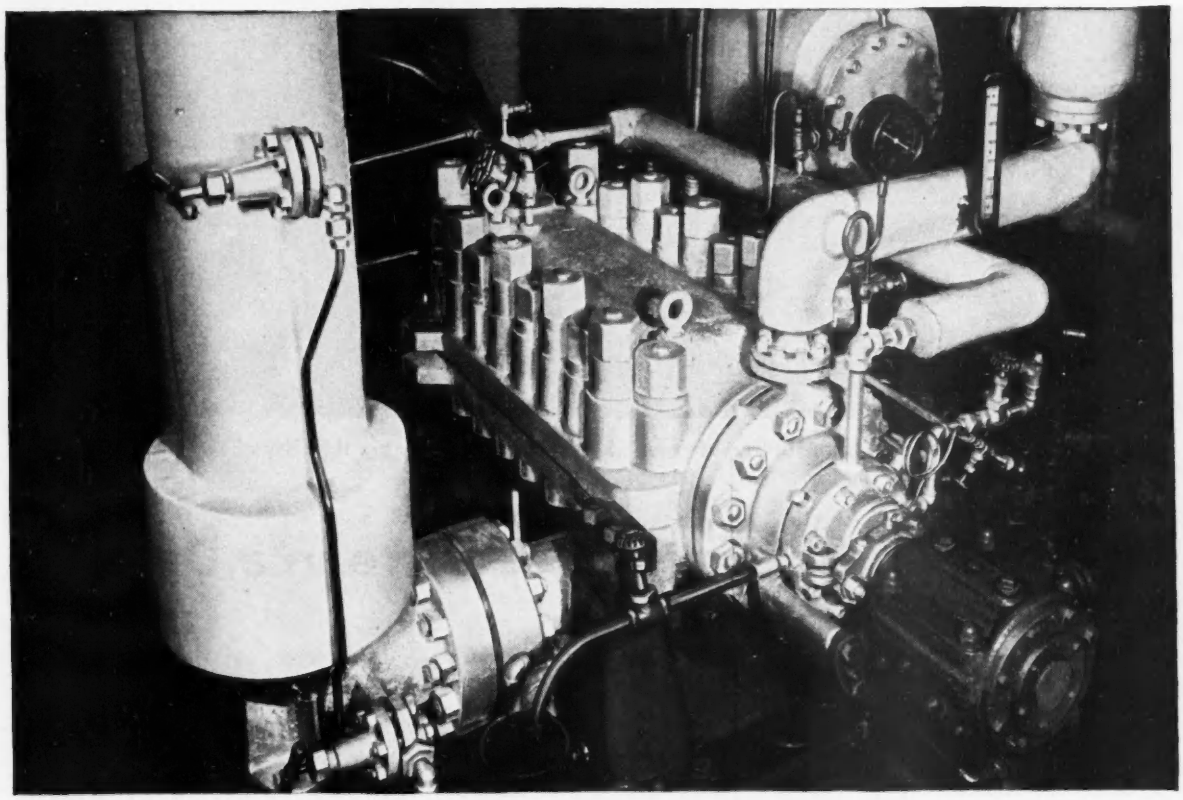
The tool, developed by Carl L. Bownds, assistant foreman, replaces knives and razors formerly used to remove the coating so that shielding can be rolled back to expose wire. This is part of a radio and electrical sub-assembly operation in which a conductor is prepared and inserted in a plug and shielding is grounded on a plug adapter terminal.

The stripper consists of two hinged maple blocks, each ¾ x ¾ x 2 in., with a channel in the inner faces and a small blade protruding from one channel. When closed, blocks confine the wire in channels that are made with a No. 30 drill.

Cutting blade is made from a No. 30 drill ground to a sharp edge. This is inserted into a hole in one block. A set screw holds the blade in position. When wire is pulled through the channels and over the blade, an even cut is made in the plastic. Plastic can then be shucked off with the thumb.

100,000 HOURS

and not opened yet!



This Ingersoll-Rand High Pressure Boiler Feed Pump installed 15 years ago has never been opened for inspection . . . and it still meets capacity and pressure requirements.

The Ingersoll-Rand Class HT pump shown above was installed in 1938 at the Windsor Station, owned jointly by The Ohio Power Company (part of the American Gas & Electric Company) and the West Penn Power Company (in the West Penn Electric Company system). Since that time, it has operated for over 100,000 hours—pumping 1025 gpm of 380° F boiler feed water at 415 psi intake and 1900 psi discharge. Throughout this entire 15 year period, the casing and high pressure breakdown have never been opened for inspection.

There are five other I-R Class HT pumps at this station. Four of these have chalked up unopened service records of from 50,000 to 80,000 hours each.

These outstanding operating records are the result of competent pump operation and feedwater control on the part of the station's personnel—and the careful material selection and high standards of construction inherent in every I-R boiler feed pump.

For *proved dependability* in high pressure service, it pays to specify Ingersoll-Rand pumps.

Ingersoll-Rand

948-10 Cameron Pump Division
11 Broadway, New York 4, N. Y.

ROCK DRILLS • COMPRESSORS • AIR & ELECTRIC TOOLS • VACUUM EQUIPMENT • PUMPS • GAS & DIESEL ENGINES

FRANK TOOL, dealer sales coordinator, moderates while three housewives say their say about salesmen as . . .

WWP Launches First Sales Drive in a Decade

Washington Water Power Co has begun its first appliance sales campaign in ten years, now that the Pacific Northwest has emerged from the shadow of winter electricity shortages.

The utility kicked off its sales program—"The Leadership Campaign"—with a rousing day-long meeting of management, salesmen, and division supervisors. What it hopes to do is persuade customers to buy—and let someone else make the sales. Even though WWP's service area is 77% saturated with water heaters and 96% saturated with electric ranges, there is still an $8 million range and heater market to be tapped.

"For the present, WWP will not engage in the appliance merchandising business," says a company publication, Dealer News. "It is expected dealer sales personnel will take the orders from prospects brought to them."

Sales Training . . . For closing sales, WWP offers dealers and their salesmen a 12-week training course in selling; will help make calls on prospects; and aim a $70,000 annual newspaper space and radio time budget almost wholly toward selling. The 22 WWP billboards are already up with a suggestion that now is the time for a bigger water heater.

For its own sales force of 50, organized under a new department of General Sales, Promotion & Information headed by Kimball I. Jack, WWP rolls out a mandatory 16-week training course. It is based on the Parker Institute General Sales Training courses. Salesmen will learn sales techniques, plus wiring and installation rates, trade-in policies of the dealers, and new and used appliance prices.

"This will be a turnabout from the past ten years," say the salesmen. "All we've sold for a long time is a few light bulbs."

But WWP has a core of veteran salesmen to pace the sales-short-of-selling program. In 1925, the old sales staff tackled electric range promotion with enough success that other utility companies were encouraged to sell them, too. In 1925, of course, the salesmen had the impetus of a promotion campaign dating from 1910.

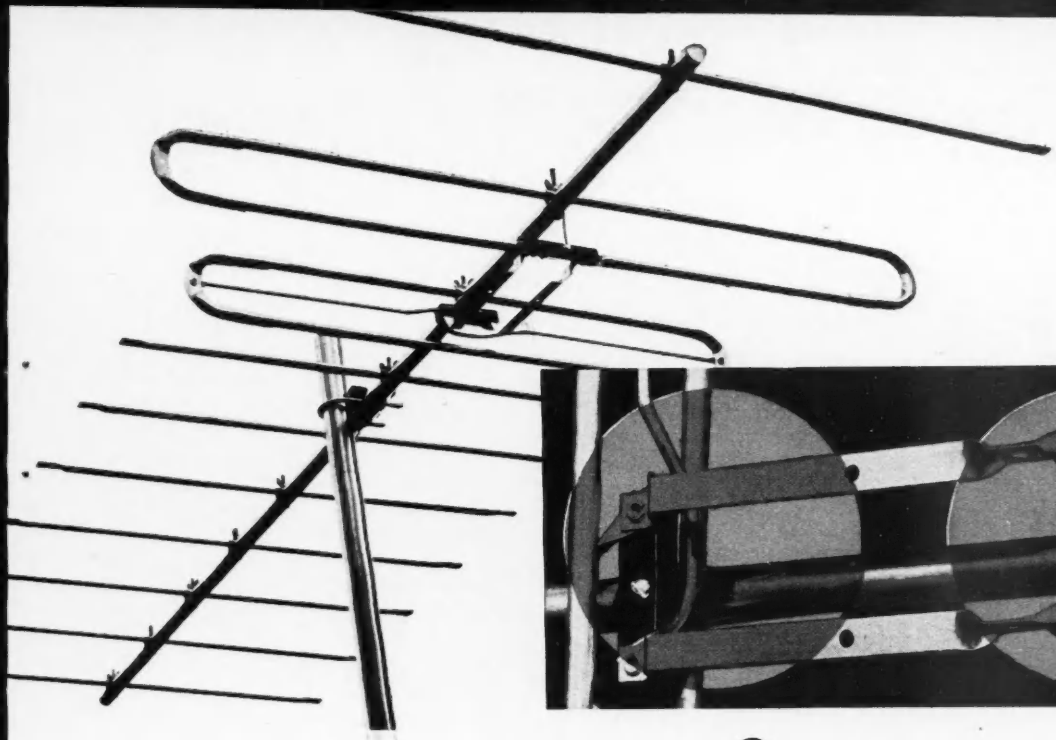
Inland Empire electric dealers move about $30 million worth of appliances annually, according to Inland Empire Electric League secretary, Robert Wilkinson.

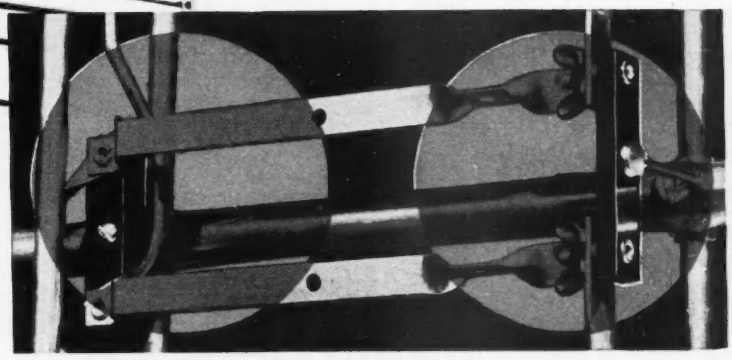
He advised WWP flatly "to sell the program to dealers first—but don't waste time with one who won't follow leads."

WWP has no intention of wasting time. Its own quota calls for selling 1,000 ranges and 600 water heaters in the first three months (October to December) to 15,000 homes that don't have them.

WWP area electricity users average 6,000 kwhr annually apiece, three times the national average, but WWP thinks this consumption can be pushed to 10,000 kwhr.

Team Proposition . . . Every appliance sold, WWP tells its employees,





economical PHENOLITE low-loss block insulators . . . on famous *CHANNEL MASTER* TV antenna

Channel Master's famous Futuramic antenna combines Broad Band TV coverage with the high gain and directivity of the Yagi. Utilizing Phenolite low-loss block insulators—the Futuramic is the one antenna that solves *today's* reception problem, yet will also receive *tomorrow's* VHF channels.

This use of Phenolite is typical of its countless applications in the electrical field. Phenolite, about one-half the weight of aluminum, is the perfect insulating material for high and low voltage applications.

It possesses an unusual combination of properties. Phenolite has great mechanical strength and high resistance to moisture; ready machinability; is unaffected by solvents and oils. It can be easily punched, sawed and sheared. Tough and with high impact strength, Phenolite is one of the strongest materials per unit weight known.

Available in various grades and colors; in sheets, rods, tubes, and special shapes. Write for literature and engineering information—

Channel Master's two dipole system—connected by Phenolite low-loss block insulated harness—makes possible the high gain and directivity of the Futuramic broad band Yagi antennas.

Illustrated: Futuramic Model 1173 broad band Yagi antenna covering channels 7-13, Channel Master Corporation, Ellenville, New York.

NATIONAL VULCANIZED FIBRE CO.

Wilmington Offices in Delaware Principal Cities

Since 1873

means more money and more jobs in the private electric industry—and the employee is a member of the selling team.

WWP even suggests that employees buy new ranges or heaters at marked down prices, and sell their used appliances to people who don't own electric heaters or ranges at present.

"The company has reached a definite need for increased revenues," reports a sales memo, adding: "All this spells out greater sales effort. Our goal is a sale on every call."

Just how appliances can improve the electric industry, WWP employees heard at their kickoff luncheon from Walter A. Toly, president of Columbia Electric & Manufacturing Co.

In 1935, he said, Columbia Electric paid a monthly electric bill of $65. But three years later, Toly sold the J. C. Penney Co a first order of 500 table lamps, and since then, Columbia's business has boomed. Today it pays WWP $2,600 a month for electricity.

"Everyone in the electric industry will benefit from your sales campaign," Toly told WWP personnel, "even the drive-in theater, if you're young enough to stand that."

Instructions Given . . . He listed five pointers for salesmen:

- Create a demand for appliances —show how they improve living.
- After you sell—service.
- Have a complete program for a customer before you talk to him.
- Never stop trying. (Toly recalled that he cajoled WWP two years in the mid-30's before getting an audience that brought a lamp sale.)
- "Never forget the customer. Pay through the nose if you have to." A customer who "makes you pay through the nose," Toly added, never forgets he has taken advantage of you. He feels sheepish; you get a booster.

Womenly Specifications . . . WWP salesmen also heard a panel of three Spokane housewives tell what they like and don't like about the operations of salesmen.

Women want salesmen "neat and courteous, to tell their story and get out." They prefer appointments rather than unexpected knocking at the house door.

Women want to talk over purchases with their husbands, even though hubby will say finally, "If you want it, buy it."

And women are interested in what an appliance does and how it looks, not its mechanics. One housewife recalled that she "about went nuts listening to salesmen talk up a refrigerator I already intended to buy—as soon as I could find a left-hand door."

WWP proposes advising prospective customers on heating and lighting plans, wiring and purchases. To dealers, they will offer traveling demonstration classes in dealers' stores with window displays and door prizes, an active promotion campaign by WWP personnel—and, most important, power to run all the appliances they hope to sell.

What brought about the sales campaign was completion of WWP's 200,000-kw Cabinet Gorge Dam in northern Idaho, doubling its generating capacity, and a good water year that allowed the Bonneville Power Administration to forecast flatly there will be no brownouts this winter in the Pacific Northwest. These are conditions that have not prevailed in this area for some years.

Demonstration Trailer Sells Clothes Dryers

In the first five weeks of use of this demonstration trailer of the Wheeling Electric Co 335 dryer loads of clothes, the weekly washes of 94 families were handled. Results were 15 dryer sales and 43 good prospects.

The trailer was built in the company garage. It carries three dryers, a range and a water heater. The trailer travels around the company service area, parking at convenient locations and housewives are invited to try out the dryers.

At almost every place it was found that the three dryers on the trailer were not enough to handle the offered loads and some had to be brought into the company's demonstration electric kitchen to be dried.

Normally working the trailer are three people: a home service girl, a dealer representative and a salesman. When the trailer was first sent out they had a time persuading housewives to give the dryers a trial. Sometimes they took down wet clothes hanging in back yards after reluctant permission had been given. But since word of the demonstration has gotten around, plenty of work comes to the trailer wherever it is parked.

WE MAKE OUR OWN RAIN . . .

Victor No. 245-R Transmission Pintype undergoing standard EEI-NEMA wet flashover test in the Victor Laboratory.

TO GIVE YOU

PROVEN WET WEATHER PROTECTION

The superiority of Victor design and manufacture is proven in the laboratory as well as in the field. Take Victor High Voltage Pintypes, for example. Here, in the wet flashover test shown above, the insulator is being subjected to controlled artificial rain while 60-cycle current is applied in gradually increased voltage steps until flashover occurs.

This is only one of the many tests which are constantly being made in the Victor Testing Laboratories to assure you of highest quality and conformance to specifications. That is why Victor Transmission Pintypes give you proven wet weather protection and longer, trouble-free service on your lines. Choose Victor — the power man's best buy!

VICTOR No. 245-R
EEI-NEMA Class 56-3

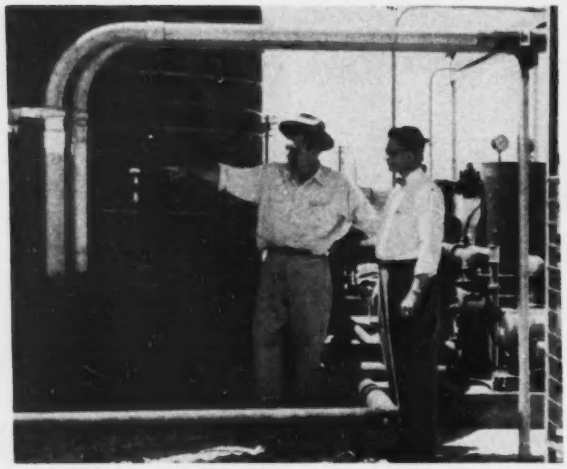
FREE BOOKLET gives you the full story of how Victor Insulators are made, how and why Purified Porcelain was developed. Write us for your copy.

Specify

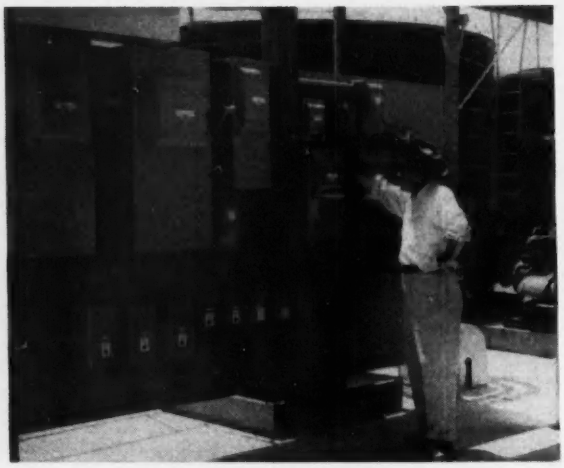
VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain



THERMOSTATIC CONTROL of temperature of 10,000-gal storage tank maintains heavy asphalt at about 300 F for use in emulsifying process



CONTROL PANEL for asphalt emulsion plant includes equipment for 50 kw of tank heating, 12.5 kw of heating cable and 52.5 motor hp

Tank Heaters Warm Heavy Asphalt

R. M. PIZZA, Consultant, Business Development Dept, Utah Power & Light Co, Salt Lake City

Electric tank heating will maintain accurate temperature control of heavy asphalt in storage without danger of introducing moisture into the material. Elimination of steam lines frees Utah Emulsions Co from worry and cost of repairing leaks in steam heating system.

Utah Emulsions produces an asphalt emulsion road sealing mix for Salt Lake area. In this process, asphalt must be kept free from moisture until it is emulsified. It is delivered at about 300 F and must be maintained at about 325 F during emulsification. Process flow lines will be heated with 12.5 kw of wrap-around electric heating cable to maintain the higher temperature. In the few installations where electric heat is used for tank and pipe heating, reports indicate satisfactory operation.

Company chose a 50-kw electric coil heater for their 10,000-gal heavy asphalt storage tank. Heater was made locally from 4x¼-in. steel strips and operates at 60 v. In addition to the 10,000-gal storage tank, the plant has two 10,000-gal emulsion storage tanks. There are also eight motors with a total rating of 52.5 hp. Total connected load is 102.5 kw, of which more than 50% is comprised of electric heating equipment.

Induction Heat Steps Up Hardening 1000%

Hardening of textile machinery parts has been stepped up more than 1000 percent at the Whitin Machine Works in Whitinsville, Mass., through use of a 50-kw induction heater.

According to Whitin engineers, the heater hardens bottom twister rolls at the rate of 35 an hour. Formerly the job was done by a cyanide furnace which took 3½ hr to harden 11 pieces.

The heater hardens various sized rolls up to almost 40 in. in length. Heat is applied exactly where needed, and the controls on the front of the panel easily adjust the cycle for the particular roll being hardened.

In addition, the induction heaters make the operators' job easier because of the absence of gases.

General Electric Co

MACHINERY PARTS are hardened at rate of 35 per hr by 50-kw induction heater. Note roll hardener in background. Operator's job is easier because of absence of gases

ASPLUNDH DISTRICT AND BRANCH OFFICES

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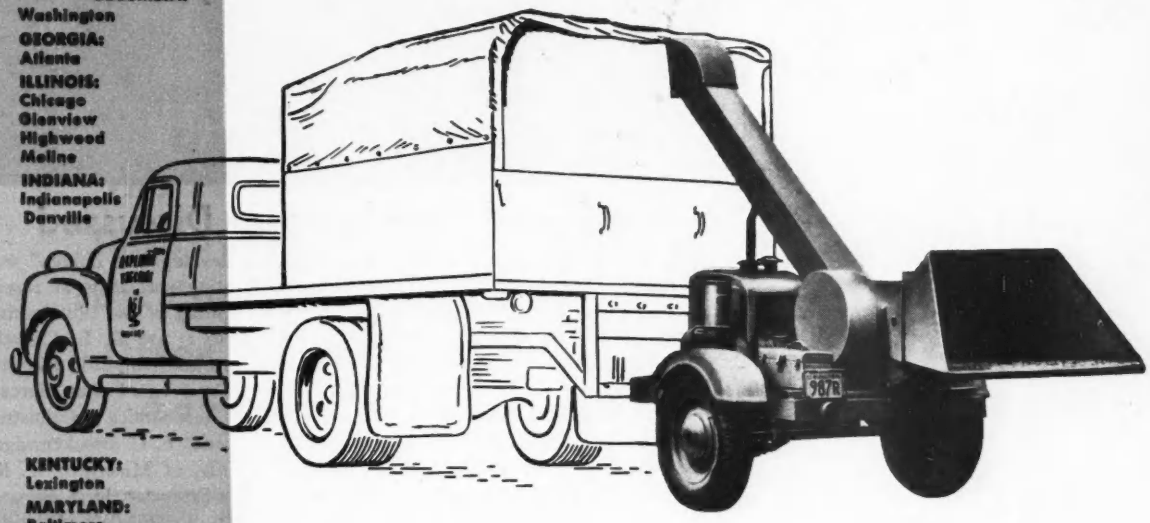
*New England Tree Expert Co. (Affiliate).

SOONER OR LATER

All Brush Disposal from Line Clearance *will be done Mechanically!*



why the Asplundh Chipper will be specified...

COMPACTNESS

The Asplundh Chipper is a complete unit, self powered by a Ford Industrial Engine. It contains fewer moving parts, is simple to maintain and adjust, has easy blade replacement and excellent weight balance.

15% TO 25% SAVINGS

The Chipper has proved to be the most economical method of disposal of brush — reducing time lost because of traffic delays and fewer number of trips. Experience shows savings of 15% to 25%.

BETTER PUBLIC RELATIONS

This modern method is approved by both property owners and the public, due to better and faster cleanup . . . no unsightly or dangerous loads to be hauled through the streets.

CITY ORDINANCES

An ever increasing number of city ordinances prohibit the disposal and burning of brush. This method meets the approval of all city ordinances. In addition, the chips have many uses.

Utilities who look behind the title...use Asplundh

ASPLUNDH TREE EXPERT COMPANY

JENKINTOWN, PENNSYLVANIA

means

Trained Treemen
Experienced Foremen
Superior Supervision
Public Relations
Specialized Equipment
Safe Operation
Complete Insurance
Efficiency Incentives
Nation-Wide Service
Sound Administration

Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous *Crapo* Galvanized heavy, ductile, tightly-bonded zinc coatings.

-and Economical, Too!

● Each size and grade of time-proved *Crapo* Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

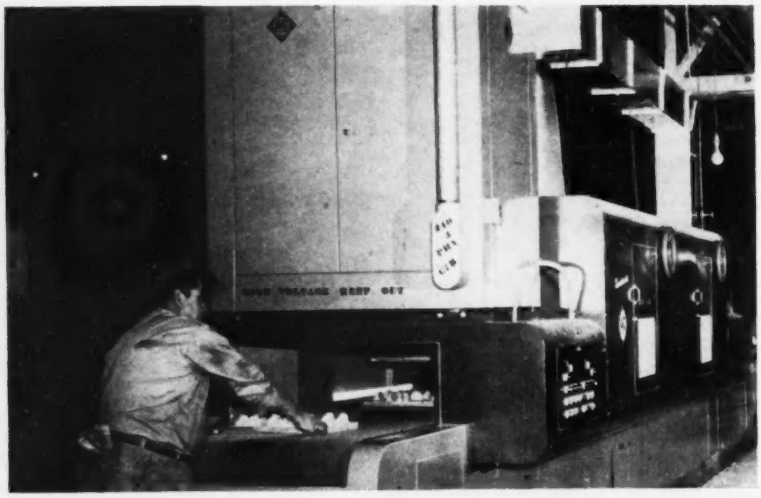
Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

Contact your jobber of *Crapo* Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

Research and Development Discussed

"How to get the most from your research and development dollars" was subject of discussion of this panel of aviation lighting specialists at recent Technical Conference of Committee on Aviation Lighting of the Illuminating Engineering Society held in Washington, D. C. (l to r) are C. L. Crouch, Technical Director, IES; D. C. Miller, GE, Committee Chairman; J. B. Rhodes, Vice President, AGA; R. E. Madigan, Line Material Co; W. C. Fisher, Bureau of Aeronautics, Navy Dept; H. J. C. Pearson, Civil Aeronautics Administration; G. M. Kevern, U. S. A. F. Air Material Command; F. C. Breckenridge, U. S. Bureau of Standards; Dr. R. H. Blackwell, Univ. of Michigan; W. R. Davies, Westinghouse, Panel Moderator, and Theodore Projector, U. S. Bureau of Standards. R and D session was held jointly with NEMA's Aviation Ground Lighting Section.

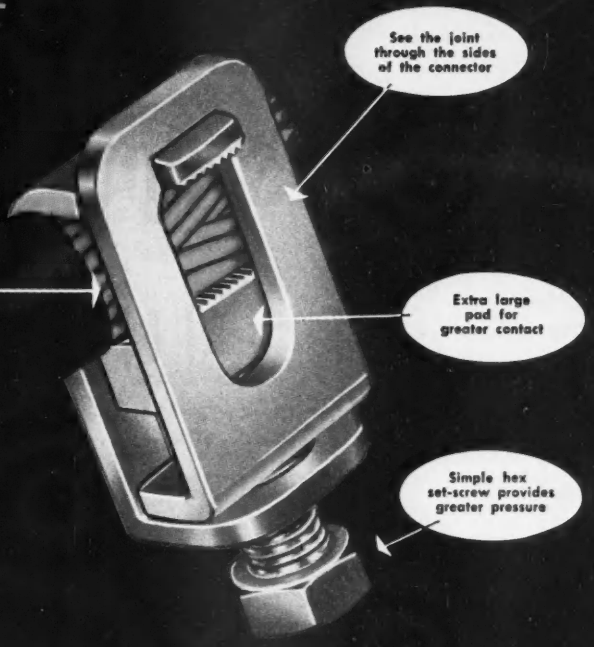


Dielectric Oven Speeds Core Baking

Core curing time is cut to 3 to 10 min with new 45-kva dielectric oven at R. H. Osbrink Co, Los Angeles, Cal. Formerly, company used fifteen 900-cu ft fuel-fired ovens and cores remained overnight in them. Only 20 min is required to progress thin wall aluminum and magnesium castings through the dielectric oven. Resin-type binders are used instead of oil types, which make knockout of core easier. Operation is much cleaner, product is better, and much space for both machinery and storage is saved. L. B. Reed, Industrial Heating Consultant, Business Agent's Division, Dept of Water and Power, City of Los Angeles, Cal.

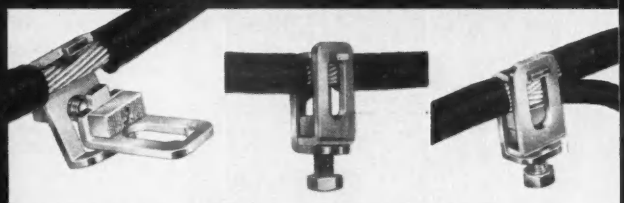
PRESENTING THE NEW

IDEAL Tap Connector


See the joint through the sides of the connector
Extra large pad for greater contact
Simple hex set-screw provides greater pressure

The First Major Improvement in Tap Connectors to Offer All These Advantages

Stronger Mechanically!
Easier to Use! Costs Less!
Only 3 Sizes Needed! Made of
Cold-Worked Steel, with Heavy Hot-Zinc Dip



ONE UNIT! **No Loose Pieces to Fall Off!**

YOU COULD DO THIS BLINDFOLDED

1. Place IDEAL Tap Connector on main **2.** Close Connector **3.** Insert Tap and Tighten

THREE SIZES for all combinations from two No. 1 wires to 1 No. 10 and one No. 12 or one No. 8 and one No. 14.

WITH SPACER BARS for copper-to-aluminum, aluminum-to-steel or copper-to-steel.

WITHOUT SPACER BARS for copper-to-copper or aluminum-to-aluminum.

The IDEAL Tap Connector is entirely new . . . designed and built to give you stronger tap connections, with less work and at lower cost per unit.

Unique Design . . . Takes fullest advantage of the greater strength of cold-worked steel, hot-zinc dipped, to make tightest connections without distortion or "bowing" of the connector.

Greater Contact Area . . . Extra large pad and stirrup distribute pressure and reduce deformation or cold-flow of wire — make low-resistance connection.

Greater Pressure . . . up to 1½ times as great as ordinary connectors.

THIS COMBINATION OF EXTRA MECHANICAL STRENGTH, GREATER CONTACT AREA AND GREATER PRESSURE ELIMINATES ALL CHANCE FOR WIRES TO WORK LOOSE, WITH RESULTING POOR CONTACTS AND POSSIBLE "BURN-OUTS".

Easier to Use . . . No parts to come loose or fall off, even in models using conductor spacers. Nothing but a wrench is needed – and you can actually see the joint from all sides.

Costs Less . . . Lower priced than other connectors for practically every combination.

Easier to Stock . . . Three sizes handle a range of combinations requiring as many as seven sizes of ordinary connectors.

Versatile . . . Use them for street taps — service drops to service entrance — dead end loops — T-taps — transformer connections — machine tool connections — grounding connections, etc.

IDEAL

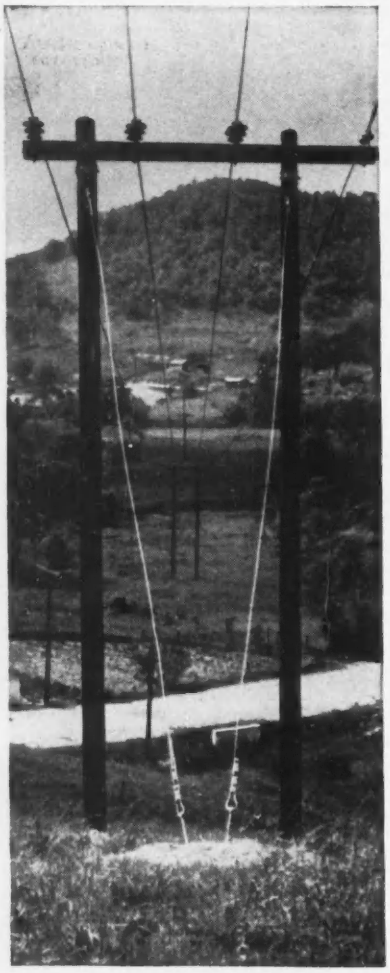
MAIL COUPON FOR FULL DATA
— How you can save money and have better tap connections.
Sold Through Leading Distributors

IDEAL INDUSTRIES, Inc., 1021 Park Avenue, Sycamore, Illinois

Please see that we get information on IDEAL'S new Tap Connector.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

Three Reasons Why Koppers Poles are Dependable



Dependable Company

Koppers Poles are made by an organization that has been a leader in the wood-preserving industry for more than half a century.

Dependable Quality

Koppers Poles are long-lasting. In the first place, they are always pressure-creosoted in strict adherence to specifications. Second, there is constant laboratory control over plant production, from a Technical Department that is foremost in the industry.

Dependable Service

Highly trained and experienced personnel in many strategically-located treating plants offer you prompt, reliable service.

* * *

You can count on *Koppers*—the best-known name in pressure-treated wood.

KOPPERS COMPANY, INC.
Wood Preserving Division · Pittsburgh 19, Pennsylvania

KOPPERS PRESSURE-CREOSOTED WOOD

INDUSTRIAL BRIEFS

Hangar lighting at Northwest Airlines' main repair base hangar, St. Paul, Minn., using 800-w reflector lamps has minimized difficult high bay luminaire maintenance. Footcandle average has been increased from 4 to 26 by replacing all 60 of the 750-w incandescent lamps with 800-w R-57 narrow beam reflector lamps. Westinghouse Electric Corp.

Heating presses at Cinderella Knitting Mills, Inc, Reamstown, Pa., with electric strip heaters (in place of steam formerly used) reduces heating up time and increases production. Fire and explosion hazard of the oil burning boiler (formerly used to provide steam) has been eliminated. A specially built-in platen in each press is heated by 24 kw in strip heaters. Norman Hartman, Industrial Representative, Pennsylvania Power & Light Co, Lancaster, Pa.

Salt bath descaling before electroplating of intricately shaped steel objects which require rust-proof protective coating is performed in an electric immersed-electrode type furnace at United Carr Fastener Corp, Cambridge, Mass. Furnace handles over 600 lb of work per hr. Parts are given a 15-min treatment in sodium hydride at 700 F compared with former method of burnishing and tumbling which required more than an hour. Blistering, peeling and hydrogen embrittlement are eliminated.

Paint drying with a ceiling mounted infrared oven saves valuable floor space and speeds production at Herschede Hall Clock Co, Cincinnati, Ohio. Oven is rated 30 kw at 230 v. It has 48 - 375-w and 48 - 250-w lamps. Three rows of 16 lamps each are located on each side of oven. Ends of oven are open and an overhead conveyor carries painted products through oven for drying. Exhaust system, operated by electric blower is located at the ends of oven to carry away fumes. Castings for parking meters and periscope heads are among products dried as they pass through oven. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

Motor Repair Service Wherever You Are

ALLIS-CHALMERS "Certified" SERVICE

Factory approved motor service in every industrial area from 101 Allis-Chalmers Certified Service Shops.

ALABAMA
Birmingham—Elec. Repair & Serv. Co.
Greenville—Mowbray Eng. Co.
Montgomery—Standard Electric Co.

ARIZONA
Bisbee—Copper Electric Co. Inc.
Phoenix—Daley Electric Company

CALIFORNIA
San Diego—Calif. Elec. Works
Los Angeles—Larsen-Hogue Elec. Co.
Oakland—Pacific Elec. Motor Co.
T. L. Rosenberg Co.
San Francisco—Weidenthal-Gostiner Electric Works

COLORADO
Denver—Baker Electric Company

CONNECTICUT
Hartford—Charles H. Leppert
Waterbury—Elec. Motor Repair Co., Inc.

FLORIDA
Jacksonville—Turner Electric Works
Miami—Peninsular Armature Works
Tampa—Tampa Armature Works, Inc.

GEORGIA
Albany—Georgia Electric Co.
Atlanta—Bearden-Thompson Elec. Co.
Columbus—Smith-Gray Electric Co.

ILLINOIS
Chicago—Chicago Electric Co.
Marion—Giles Arm. & Elec. Wks., Inc.
Mt. Vernon—Dowzer Electric Machinery Works, Inc.

INDIANA
Indianapolis—Scherer Electric Co., Inc.
Evansville—Evansville Elec. & Mfg. Co.

IOWA
Sioux City—Smith Elec. & Supply Co.

KANSAS
Salina—Cent. Kans. Elec. Mach. Co.
Wichita—Tarrant Electric Mach. Co.

LOUISIANA
New Orleans—Industrial Elec., Inc.
Shreveport—Shreveport Armature & Electric Works

MAINE
Brewer—Stanley J. Leen Co.

MARYLAND
Baltimore—Keystone Electric Co., Inc.

MASSACHUSETTS
Lawrence—Roland B. Glines Co.
Springfield—Elec. Motor Repair Co.

MICHIGAN
Detroit—Stecker Electric Company
Grand Rapids—Grand Rapids Industrial Electric Co.
Saginaw—Banning Elect. Prod. Corp.

MINNESOTA
Duluth—Mielke Electric Works, Inc.
Minneapolis—Parsons Elec. Co.

MISSISSIPPI
Vicksburg—Ludke Electric Co., Inc.

MISSOURI
Kansas City—Boese-Hilburn Elec. Co.
St. Louis—French-Gerleman Elec. Co.
Springfield—Springfield Elec. Serv. Co.

NEBRASKA
Omaha—Omaha Electrical Works

NEW HAMPSHIRE
Concord—A. S. Tracy

NEW JERSEY
Atlantic City—Charles A. Buckley
Paterson—Elec. Service Repair Co.
Trenton—Lockwood Elec. Motor Serv.

NEW MEXICO
Albuquerque—Electric Motor Company
Powell Electric Co.

NEW YORK
Buffalo—Robertson Electric Co.
Volland Elec. Equip. Co., Inc.
Flushing—Flushing Elec. Corp.
Jamestown—A. E. Westburgh
Mt. Vernon—H. A. Schreck, Inc.
New York—Consol. Elec. Motor Co.
Rochester—Vanderlinde Elec. Corp.
Utica—Mather, Evans & Diehl Co.
Watertown—Watertown Elec., Inc.

NORTH CAROLINA
Charlotte—Southern Elec. Service Co.
Greensboro—Southern Elec. Serv. Co.
Rocky Mount—Hammond Elec. Co.

OHIO
Cincinnati—Cincinnati Elec. Equip. Electric Service Co.
Akron—A-C Supply Co.
Toledo—Romanoff Elec. Motor Serv.
Youngstown—Winkle Electric Co.

OKLAHOMA
Miami—Miami Armature Works
Oklahoma City—Southwest Elec. Co.
Tulsa—Smith-Milligan Electric Co.

OREGON
Eugene—Kalen Electric & Mach. Co.
Portland—Milwaukee Mach. Co.

PENNSYLVANIA
Johnstown—Universal Elec. Mfg. Co.
Osceola Mills—Mid-State Elec. Eng. Co.
Philadelphia—Elec. App. & Repair Co.
Pittsburgh—Penn. Elec. Coil Corp.
York—Industrial Electric Company

SOUTH CAROLINA
Greenville—Southern Elec. Serv. Co.
Spartanburg—Southern Elec. Serv. Co.

SOUTH DAKOTA
Sioux Falls—Electric Motor Repair

TENNESSEE
Columbia—Middle Tenn. Arm. Wks.
LaFollette—Standard Arm. Works, Inc.
Memphis—Indus. Elec. & Supply Co.

TEXAS
Amarillo—G. E. Jones Elec. Co.
Beaumont—Elec. Mach. & Repair Co.
Dallas—Industrial Elec. Equipment Co.
El Paso—B & M Machinery Co.
Fort Worth—Central Electric Co.
Houston—Roy A. Berentz Co.
Sweetwater—Sweetwater Electric Co.

UTAH
Salt Lake City—Diamond Electric Motor Repair

VIRGINIA
Richmond—Wingfield & Hundley
Roanoke—Virginia Armature Co.

WASHINGTON
Spokane—Lee F. Austin Company

WEST VIRGINIA
Charleston—Charleston Elec. Supply
Fairmont—West Virginia Armature Co. of Fairmont, Inc.
Morgantown—Galis Elec. Repair Co.

WISCONSIN
Baraboo—Utility Trans. & Equip. Co.
Green Bay—Beemster Electric Co.
Milwaukee—Dietz Electric Co.
Wausau—Electric Motor Service
Wisconsin Rapids—Staub's Elec. Wks.

ALLIS-CHALMERS CERTIFIED SERVICE SHOPS are independent service shops which have met rigid standards for ability, experience, equipment and business integrity. They use factory approved methods and parts and do your work promptly at a fair price.

Of course, Allis-Chalmers Certified Service Shops give good service on any electrical equipment, of any make. Tear out this ad and save it, or write the name of the A-C Certified Service Shop nearest you in your address book. Allis-Chalmers, Milwaukee 1, Wisconsin. A-4197

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

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Sold . . .
Applied . . .
Serviced . . .

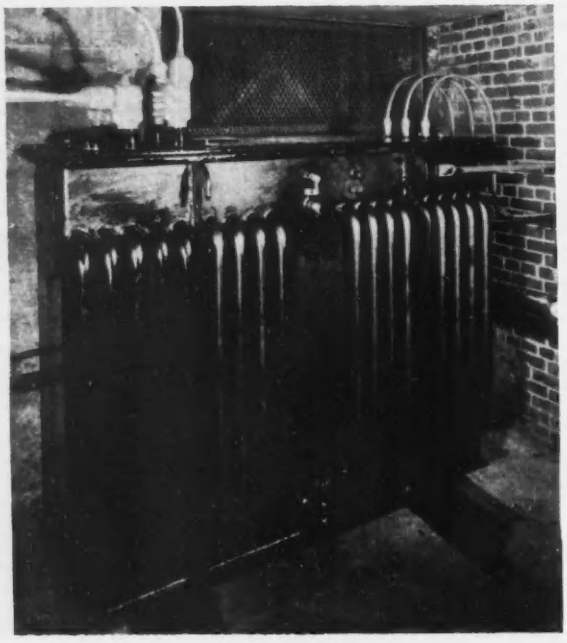
by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

NEW EQUIPMENT



Transformers

A new line of transformers that embody either three or four standard distribution transformer core-and-coil assemblies has been announced. The units, called Power Pac Assemblies, have either three-phase or single-phase and three-phase secondaries, depending on the number of coils. Advantages claimed include simple and low-cost installation, safety to operating personnel, reduced vault space requirements, and low wiring expense.

Field work is kept to a minimum because all interconnections between coils within the tank are factory made. Primary fuse links, rated at 10,000-amp interrupting capacity, are encased in fibre tubing and mounted within the tank. Secondary current transformers and potential transformers can be installed for metering. Where potential transformers are not needed, secondary potential connections are brought to the metering lead box.

Units with three-phase, 120/208-v, secondaries are available up to 300 kva. Combination units with single- and three-phase secondaries, 120/240 v and 240 v, are rated up to 200 kva. Primary voltage of units is 4,160 v wye.

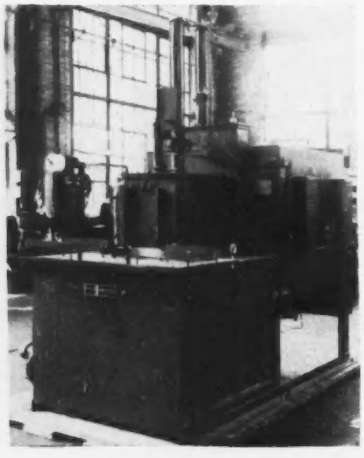
Pennsylvania Transformer Co, Canonsburg, Pa.

Heat-Treating Furnace

An electric forced convection furnace that provides automatic control of temperatures and atmosphere throughout both the heating and quenching cycles has been announced. It can be used between temperatures of 1,500 to 1,750F, and throughout a carbon range of 0.15 to 1.15% for hardening or carbon restoration.

The Homocarb furnace combines in one unit a heating chamber, a quench tank, and a protective-atmosphere vestibule. Active carbon in the atmosphere is continuously measured and controlled by Microcarb atmosphere control. Temperature of both heating chamber and quench tank are automatically controlled. From the time a load enters the furnace until it leaves the quench it is never exposed to air.

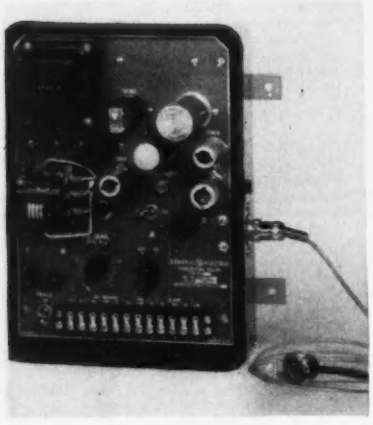
Leeds & Northrup Co, 4908 Stenton Ave., Philadelphia 44, Pa.



Vibration Relay

A new vibration relay for protecting apparatus that is left unattended, such as large generators, motors, etc has been announced. It can be used on equipment having speeds from 300 to 18,000 rpm to energize warning-alarm, corrective, or shut-down devices at pre-set vibration acceleration values up to 20g. Easy calibration in the field, safe installation where dust conditions exist, and a fail safe warning are features claimed for the relay.

Relay responds to a signal from a barium titanate crystal accelerometer that is attached to equipment to be protected. The signal is amplified through a cathode follower and two-stage amplifier, then rectified by a bridge-type rectifier. This output operates a single-pole, double-throw relay, the contacts of which actuate the alarm or shut-down device.



The relay responds to frequencies from 5 to 300 cps with an accuracy of ±10%. Power input is 105/125 v, 50-60 cps, 0.5 amp.

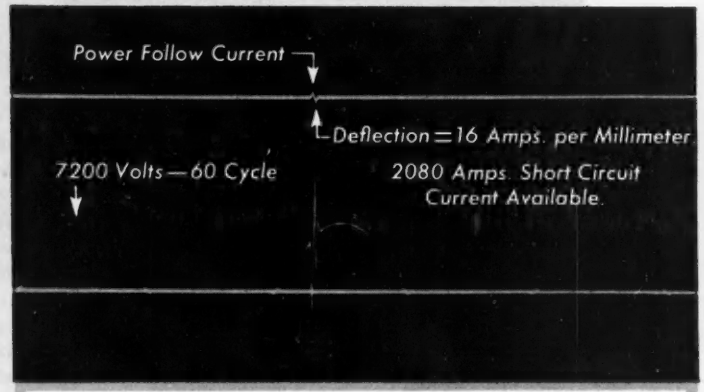
General Electric Co, Schenectady 5, N. Y.

Carrier System

A new carrier telephone system providing up to 12 carrier-derived voice channels on an open wire line has been announced. Type 45A sys-

More Engineers Every Year *Specify* PROTECTION BY AUTOGAPS

HERE'S WHY!



The oscillogram above shows typical Autogap duty cycle operation. Note that the power follow current is negligible since the conduction period is limited to the duration of the surge.

The HUBBARD Autogap Lightning Arrester is the *only* arrester designed to operate without power follow current, and several distinct benefits result from this exclusive feature:

Universal in application. The Autogap may be located without regard to system short circuit capacity — a "must" for today's increasing urban loads and extended rural systems.

No tripping of lines. Sectionalizing device operations are reduced to fault conditions only.

Long life. Without power follow erosion, arrester life is estimated to be independent of electrical activity.

Consistent level of protection. Impulse protection level remains unchanged, without power follow carbonization or tracking.

How it works. A special barrier plug develops high gas pressure from the surge itself, so the system current is not required to form the expulsion gases. *Twin vents* aid the expulsion action.

The superior performance of the Hubbard Autogap is not a projected claim from laboratory tests, but has been proven by over 14 years' actual experience in hundreds of thousands of installations the country over.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

When Life's at Stake Rely on...

KLEIN

Show the familiar Klein trademark to the old-timer on the pole and he'll tell you—"that's the equipment I've been using ever since I was a grunt."

Yes, workmen just naturally feel safer when the equipment is Klein—recognized for quality "Since 1857."

ASK YOUR SUPPLIER
Foreign Distributor: International Standard Electric Corp., New York.

Write for your free copy of the Klein Pocket Tool Guide today!

Since 1857

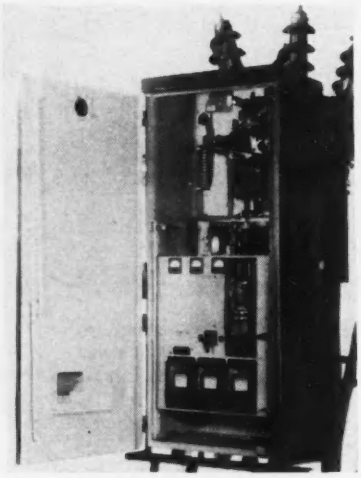
Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVE CHICAGO 18 ILL

tems can be installed on lines already equipped with carrier systems using frequencies up to 35 kc. Four staggered frequency allocations are available to permit installation of several systems on a single pole line.

Sufficient gain and regulation permits repeater spacing of 170 miles in non-sleet areas. Broadband regulator provides up to 48 db of flat loss correction at 99 kc and up to 24 db of slope correction between 99 and 150 kc. Individual regulators in each channel compensate for up to 7 db of attenuation due to line absorption peaks.

Equipment is miniaturized and makes use of plug-in, interchangeable units. It occupies 31½ in. on a standard 19-in. equipment rack.

Lenkurt Electric Co, Inc, San Carlos, Calif.



Circuit Breaker

A new 3-phase oil circuit breaker for 14.4- and 23-kv distribution service is available. The Type G breaker utilizes a single oil tank to contain all three poles that are designed with one enlarged De-ion grid arc interrupter per pole. This is said to provide ample short-circuit capacity with small overall dimensions.

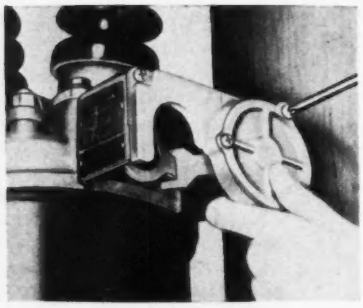
The operating solenoid, control relays, terminal blocks, and rectifier (when required for ac control) are mounted on the back of a housing. Space is provided for the addition of a panel carrying reclosing relay, protective relays, ammeters, and control switch. Continuous current ratings are available up to 1,200 amp with 8-cycles arc interruption up to 250 Mva. Frame height is such that live parts meet National Safety Code requirements.

Westinghouse Electric Corp, 401 Liberty Ave., Pittsburgh 30, Pa.

Lighting Control

A new 575-w photoelectric control for outdoor lighting has just been announced. Series 64400 control is a small, compact, lightweight unit easily adapted to different mountings. Accessories are available for mounting on luminaire, wood pole or cross arm, ballast, standard, etc. For controlling street lights, the low initial cost and savings in wiring, other materials, and labor make it economical to use one control per lamp, it is claimed.

Fisher-Pierce Co, Inc, 170 Pearl St., S. Braintree, Boston 85, Mass.



Recloser Control

A new manual remote control for operating Type H oil circuit reclosers has been developed. It provides an accessible handle near the pole's base and is said to eliminate the need for

(*Continued on page* 183)

Meet Al Schieber, Assistant Manager, Westinghouse Electric Utility Dept. On the next seven pages he leads a discussion on . . .

Guarding your high-cost equipment against damaging faults

A. L. Schieber has spent the last 40 years at Westinghouse helping solve utility problems. This insert covers "equipment that protects equipment" and Al has seen much of it develop from its beginnings as an idea in an engineer's mind.

"A new development promises to extend the usefulness of power line carrier in system protection. Frank Gunter of Carrier Engineering tells how . . ."

This new power line carrier equipment gives you more channels

On many systems there is a shortage of power line carrier channels for relaying, telemetering, load control, remote tripping and communication. The new FD equipment just developed packs more channels into the same frequency spectrum, gives you additional opportunities for system protection.

A combination of Westinghouse developments makes this possible. One of these is crystal control, which is used in the carrier transmitters to hold each channel exactly on frequency. Since one channel can't drift into another and create interference, the channels can be placed closer together. Spurious or harmonic outputs that are so characteristic of some electronic circuits have been reduced to a minimum in the FD equipment. This means less interference between channels—less need for space between channels—more room for additional channels. Coupled with these transmitter improvements are refinements in receiver selectivity, sensitivity and noise reduction. These receiver design changes contribute greatly to the more efficient use of the available frequency spectrum.

A very important feature of the new FD equipment is the frequency shift equipment (or assembly). The operator above is checking it with a frequency counter. Using this improved frequency shift apparatus, telemetering, supervisory control and remote tripping, each requires an r.f. bandwidth of only 120 cycles!

For additional information on how you can get more channels and more flexibility with type FD power line carrier equipment, write to Westinghouse Electric Corporation, Carrier-Microwave Section, 2519 Wilkens Avenue, Baltimore 3, Md.

YOU CAN BE **SURE**...IF IT'S

"Relays are basic to transmission protection . . . Bill Sonnemann, Manager, Relay Engineering, tells you about the latest relay developments."

Improved carrier relaying acts instantly to clear faults

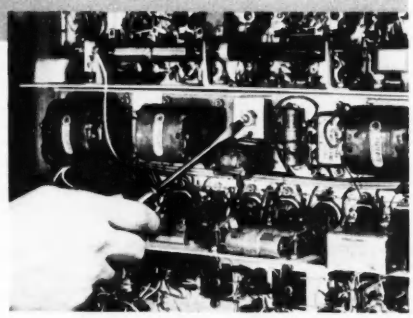
A positive way to isolate faulted sections of a transmission line is provided by HKB carrier relaying. You can't buy better protection for your high capital investment in your transmission system. This relaying system compares conditions at the terminals of a section of line. Power line carrier equipment such as shown on the opposite page enables the relays to make this comparison. When a fault occurs *within* the protected section, breakers at each end are tripped simultaneously. This is desirable from the standpoint of stability, continuity of service, quick reclosing and minimum damage to equipment.

Westinghouse HKB carrier relaying has been improved by the use of vacuum tubes to replace the thyratrons formerly used in the control unit. The vacuum tubes are continuously grid-controlled, providing surer action. An added advantage is that the vacuum tubes may be tested at any time on conventional tube-testing equipment. Since weak tubes can be detected and discarded, you can be sure at all times that the equipment will work when it is needed.

The new control unit used with the Westinghouse HKB equipment contains a new phase-shifting network. This network may be adjusted to compensate for phase shift due to an extra-long transmission line. The adjustment may be made easily in the field and it adds considerably to the flexibility of the relaying system.

These improvements in the HKB relaying system are typical of the engineering developments that make Westinghouse a leader in the relay field. For more information on HKB carrier relaying and on other relaying systems, contact your Westinghouse representative.

J-40447



A simple screw driver adjustment made in the field matches the HKB to extra-long lines.

Westinghouse

"The power circuit breaker is the key to modern system protection. Jack Stirling discusses . . ."*

De-ion interruption . . . key element in modern breaker design

Here is one of the most important developments ever made for system protection—the De-ion* grid which is standard on all Westinghouse power breakers. These breakers, being mechanically as well as electrically *trip free,* insure top-speed contact separation after reclosing as well as initially on a fault.

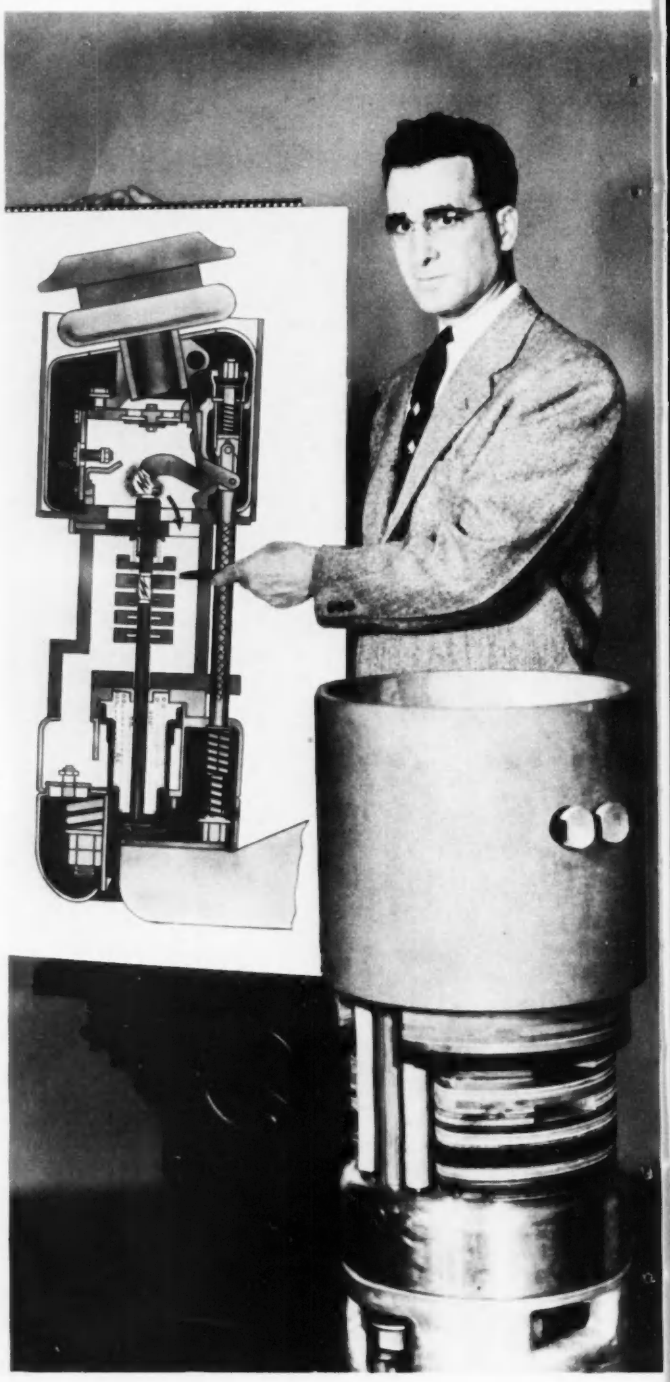
In this high-capacity, high-voltage De-ion grid, the arc literally snuffs itself out. The multi-flow principle limits arcing to one cycle, or less, and total clearing over the entire current range is *not more than three cycles.*

Even when the breaker is reclosed in 15-20 cycles, the De-ion grid has been completely scavenged of arc products making it ready for an immediate 3-cycle interruption if necessary. This high-speed isolation of faults, and high-speed reclosing ability, not only protects your equipment, but also improves your system operation.

For the past 28 years, the designers of Westinghouse breakers have had an invaluable tool—the famous High Power Laboratory. It means that every rating of breaker is thoroughly proved to give you the high level of protection you require.

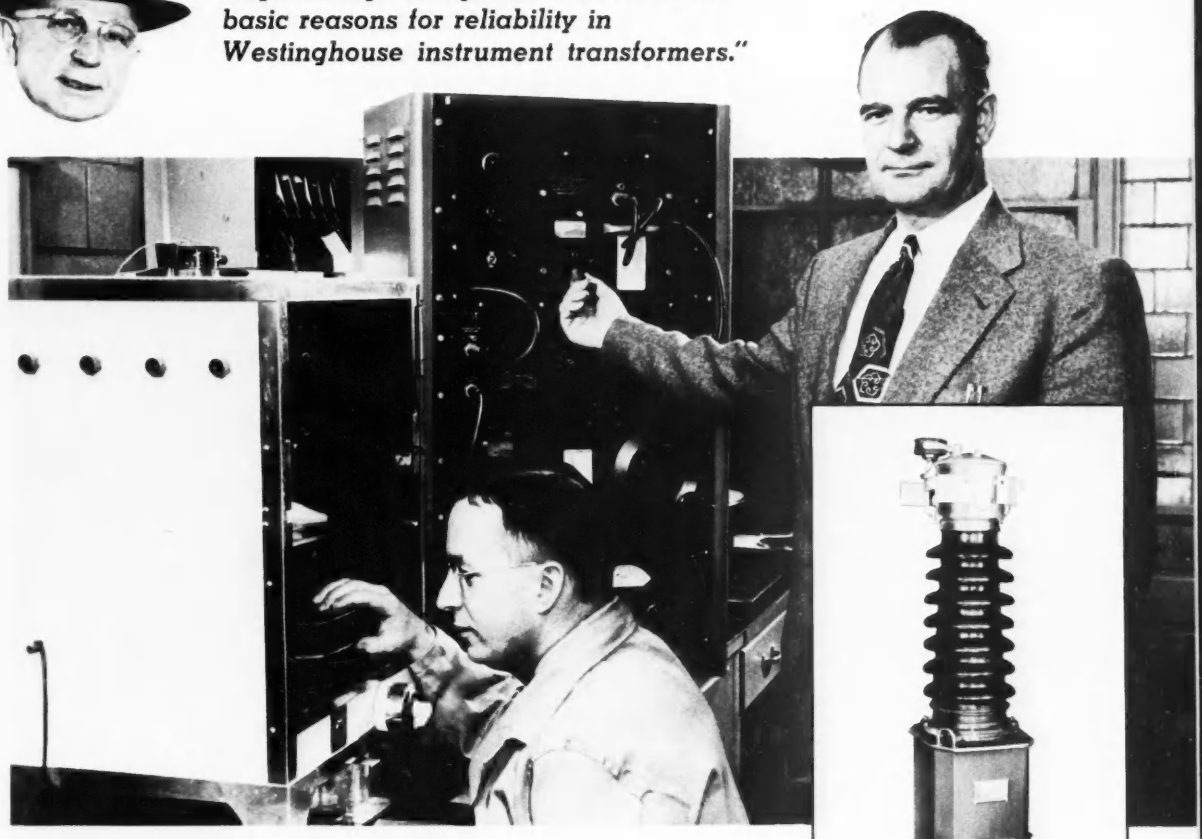
When you're planning a new breaker installation, call Westinghouse early or write now for Descriptive Data 33-160. J-60832

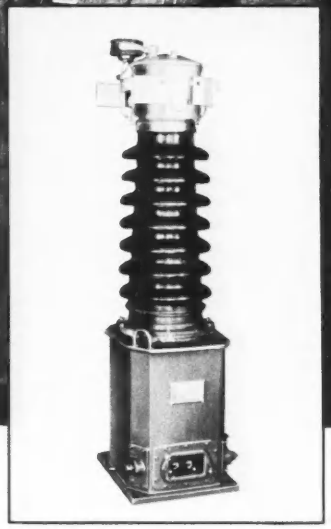
*Manager, Power Breaker Application Engineering



YOU CAN BE **SURE**...IF IT'S

"Here's Jim Ford, Manager, Manufacturing Engineering, who points out one of the basic reasons for reliability in Westinghouse instrument transformers."





Power factor control means added reliability in instrument transformers

Obviously, the larger your investment in capital equipment, the more you must be sure of reliability as well as accuracy in your instrument transformers. Here's an example of Westinghouse practice which assures vital reliability. . .

Materials having an insulating job to do—including oil, Inerteen®, pressboard, paper and similar insulating materials are given extensive quality checks including power factor.

Insulation when stressed may tend to heat up due to power-factor losses. This heating in turn increases the power factor which again increases the loss. If the power factor is controlled within permissible limits for the application, the losses can be dissipated before this destructive cycle can start . . . and, more importantly, before your equipment is affected.

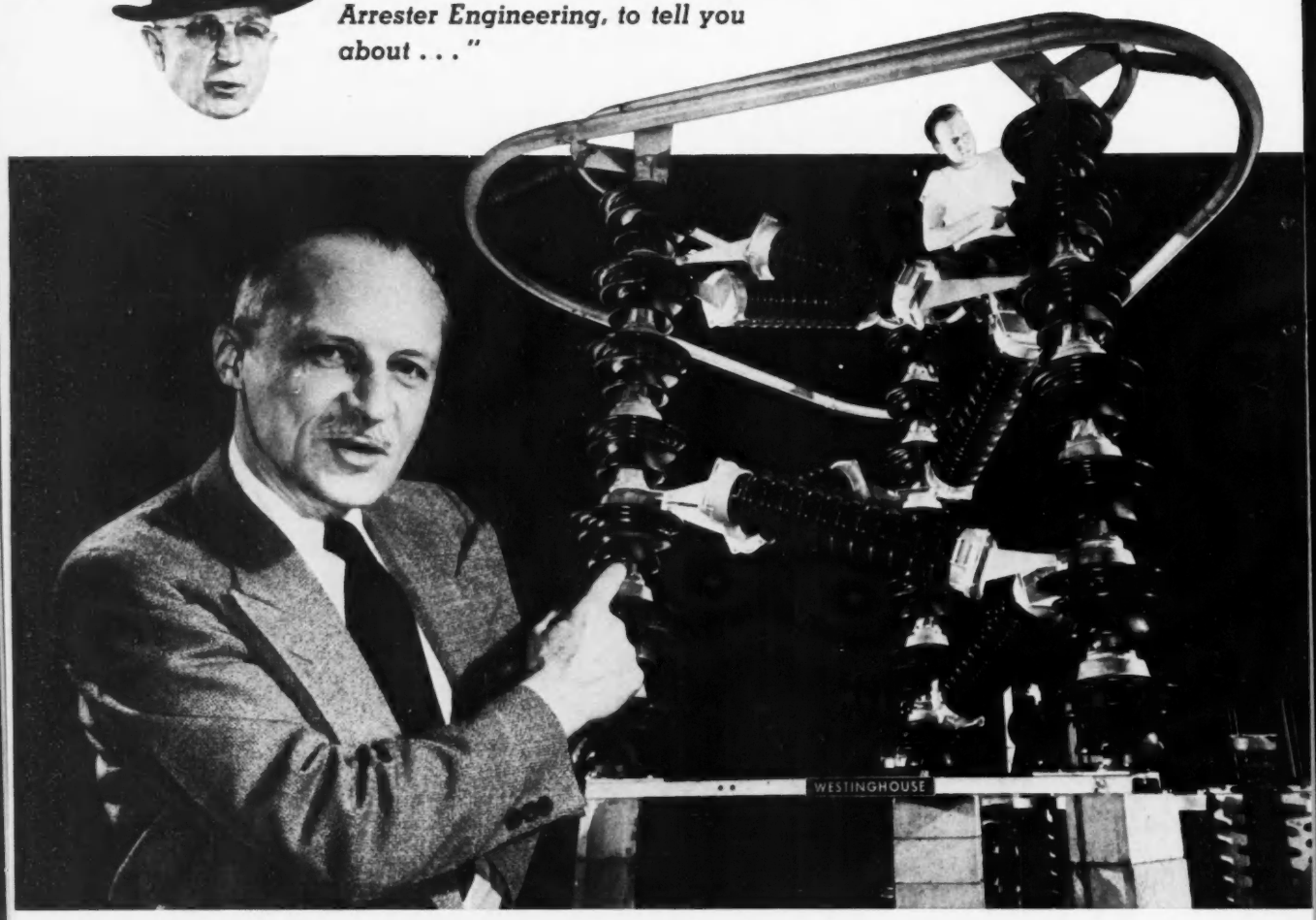
Westinghouse has steadily improved the control and application of materials used in its apparatus to assure satisfactory operation of modern Westinghouse instrument transformers.

This excellent control of the quality and use of materials, plus the superior quality of Hipersil® cores and oxygen-free copper, make Westinghouse instrument transformers the best on the market for reliability and sustained accuracy. The sealed indoor and outdoor vacuum-pressure, plastic-filled units pioneered by Westinghouse, and the sealed oil-insulated outdoor units are typical plus values for service continuity.

If you are interested in how Westinghouse instrument transformers can add to the protection of your high capital investment, call your nearby Westinghouse representative. J-70695

Westinghouse

"Here's Ed Beck, Manager of Lightning Arrester Engineering, to tell you about . . ."



Unique new tripod design . . . Better lightning protection at 230 kv and up!

With its new tripod mounting, the Westinghouse SV arrester now provides even better protection against lightning surges for systems rated 230 kv and up. The more compact design results in better voltage distribution along the arrester. This minimizes the distorting effect of the electrostatic field and maintains high surge discharge characteristics.

The more compact design also eliminates the need for supporting towers and saves installation costs. And substation designers will like the lower overall height.

The surge capacity and characteristics of Westinghouse SV arresters exceed industry standards. No modern power transformer has *ever* been damaged by lightning when protected by an integrally-mounted SV arrester.

Westinghouse, in cooperation with many utilities, has been foremost in the study of lightning phenomena since 1926 when the Westinghouse Klydonograph made possible the original lightning studies.

Your expensive equipment deserves the high level of protection available in the SV arrester. Write for bulletin DB-38-120. J-60831

YOU CAN BE **SURE**...IF IT'S

"The protection of low-voltage circuits took a big step forward when Westinghouse developed the DB breaker. M. E. Horn discusses . . ."*

Instantaneous protection and delayed tripping . . . just the combination you need

The DB breaker contains a multi-purpose tripping mechanism which . . . (1) provides delayed tripping on temporary overloads, (2) trips on larger overloads before damage can be done, and (3) trips instantly on short circuits.

This single tripping mechanism has a wide combination of settings for delayed and instantaneous tripping. You can easily adjust it to provide the best protection and most practical operation for *your particular job.*

Here is the kind of operation this flexibility permits. You can install 50-amp breakers nearest the load and back them up with 225-amp breakers. A 600-amp breaker would supply the system. Now by proper coordination, a 50-amp breaker will trip on overload while the rest of the system keeps functioning.

DB breakers are built from highly flexible subassemblies and are designed for mounting in switchgear assemblies. Single circuit breakers are available in a variety of enclosures: such as general-purpose, weatherproof, explosion-proof, etc.

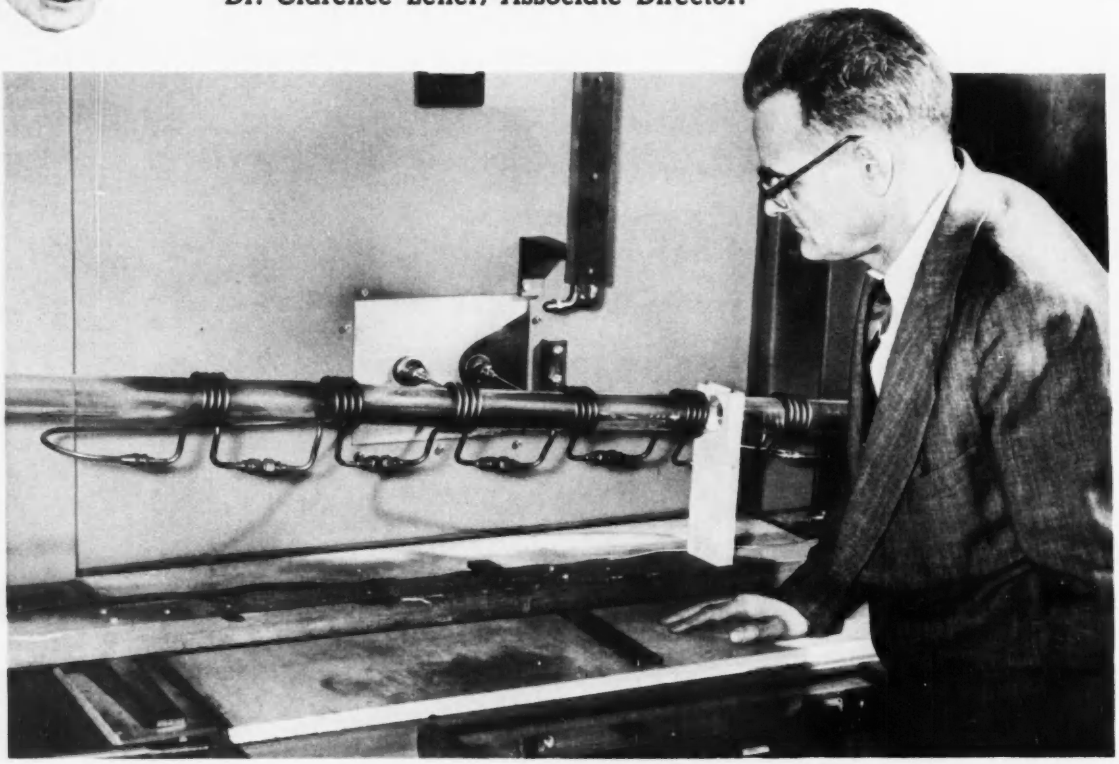
Get more information on these outstanding breakers. Write now for Booklets 4067 and 4740.

J-60830

*Manager, Low-Voltage Air Breaker Engineering

Westinghouse

"Most of the products discussed here have their roots in the exciting atmosphere of the Westinghouse Research Laboratories. Here's Dr. Clarence Zener, Associate Director."



For better system protection: Germanium 99.99999999% pure!

Here is a good example of what we call *basic* research—developing new materials and processes to improve the equipment we build. This laboratory process precipitates germanium that contains only one part impurity in ten billion!

We're using this intensely pure material in studies of "semiconductors", such as the wonderful new transistors which have such great application to relaying, microwave and other system protective devices.

Basic research accounts for about 50% of our activity. Another 40% is devoted to *fundamental* research—pure science which operates on the frontiers of human knowledge. In recent years, we have done a great deal of work in "solid state physics" which embraces semiconductors.

We expect our work to continue as a keystone in solving system protection and other utility problems. CP-1007 CP-4

For more information on the products described in this 8-page advertisement, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

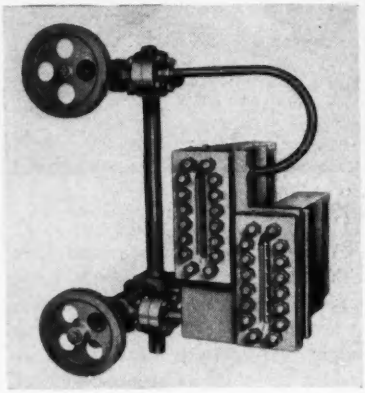
Basic research has really paid off in lightning arresters. We developed the Rutile Button which produces ionization in the spark gap at a voltage below the impulse sparkover. When lightning strikes, this *pre-ionizes* the gap. As the surge builds up——BANG!—the Westinghouse SV arrester *always* sparks over at the designed value.

YOU CAN BE **SURE**... IF IT'S

Westinghouse

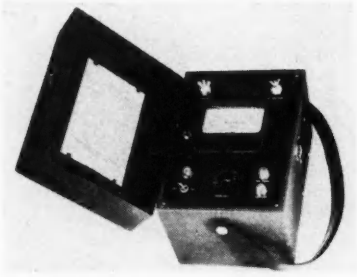
(*Continued from page* 174)
climbing. The control consists of a permanently lubricated mechanism that engages the recloser operating handle, a housed flexible cable, and an operating arm that is mounted near the pole's base.

Although the control operating handle may be locked, the recloser operating handle can move to lockout position without interference. The control can be used either to open or close a recloser. It is available for ganged operation of one, two, or three reclosers of muli-phase installations.
Line Material Co, 700 W. Michigan St., Milwaukee 1, Wis.



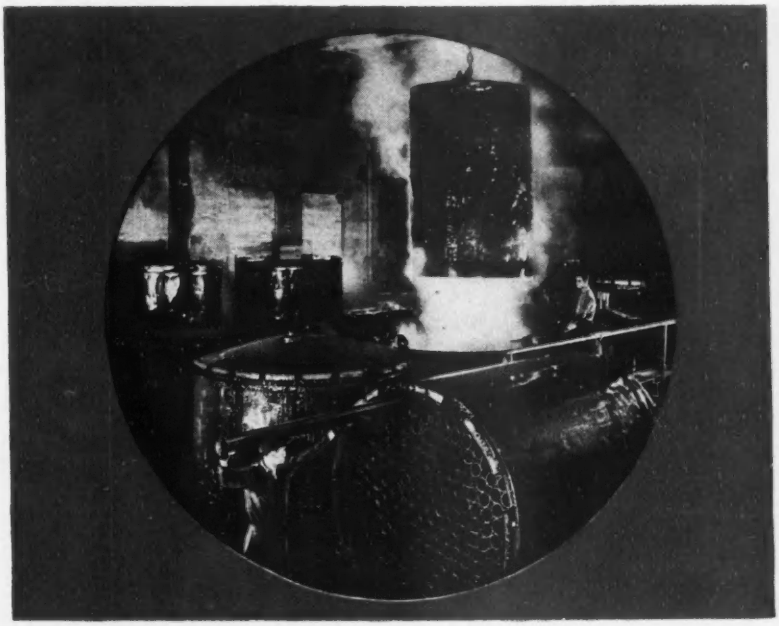
Boiler Gauge

A new boiler gauge has been developed that is said to eliminate serious strains on the glass, which cause breakage. The gauge's glass is divided into a series of short sections, accurately fitted, and mounted with thin mica separators in the joints. These sectional glass gauges are furnished for pressures above 1,350 psi.
Diamond Power Specialty Corp, Lancaster, Ohio



High-Voltage Tester

A new high-voltage testing instrument called Hypot Junior Model No.



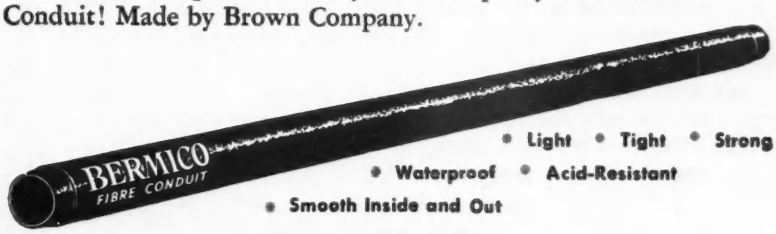
"Blending"

BERMICO® FIBRE CONDUIT

. . . for perfect uniformity Here, in the impregnation phase of Bermico's production, wood fibre and coal tar pitch become as *one* substance. Under vacuum, sturdy wood fibre tubes are thoroughly infused with tough preservative. The result is Bermico Fibre Conduit—*completely uniform* from end to end!

Bermico's uniform impregnation is matched by: *uniform wall thickness . . . uniform diameter of bore . . . uniform quality of fibre.* This pattern of uniformity is the result of production that features automatic forming and processing . . . close controls over the drying process . . . machining of taper and length . . . four rigid factory inspections.

For the best protection for your cable specify Bermico Fibre Conduit! Made by Brown Company.



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OFTEN THERE IS NO SUBSTITUTE FOR A *GOOD LOOK*

That's Why Industry Needs the DIAMOND "UTILISCOPE"

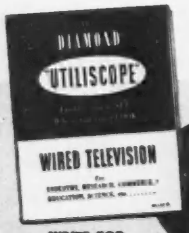
(WIRED TELEVISION)

A description may help find a suspect, but before identification can be positive enough to stand in court, somebody who knows the man must take a good look at him.

In many industrial processes, there also is no substitute for a good look. Correct control depends upon the operator having a SENSE OF REALISM that instruments cannot provide . . . that SEEING alone can give.

The Diamond "Utiliscope" (wired television) enables the operator to have a "good look" at all times no matter how remote, inaccessible or dangerous the location of the process. The "Utiliscope" is exceptionally rugged, reliable, and moderate in cost. There undoubtedly are places in your plant where it will save money, improve quality, promote safety and/or reduce manpower requirements. Write for Bulletin.

TYPICAL USES—Studying destructive tests of engines • Watching flow of molten steel • Checking remote gauge readings • Observing conditions inside furnaces • Viewing nuclear research • Coordinating materials flow on conveyors • The "Utiliscope" (Registered U. S. Patent Office)



DIAMOND POWER SPECIALTY CORP.

FIRST IN INDUSTRIAL TELEVISION

LANCASTER, OHIO • *OFFICES IN 39 PRINCIPAL CITIES*

Diamond Specialty Limited—Windsor, Ontario

WRITE FOR BULLETIN 1025 W

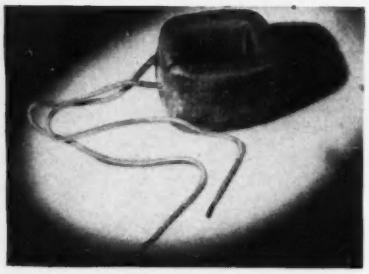
Since 1903, Diamond has Manufactured Quality Equipment For Industry

6064

422 has been announced. The instrument features visual indication of leakage and breakdown on a kilovolt meter having an accuracy of ±3% of full scale. Output voltage is variable from 0 to 10 kv ac, and input is 115 v, 60 cps.

Instrument is housed in a steel case 11½ x 8½ x 10 in. with a removable hinged cover. Net weight is approximately 25 lb.

Associated Research, Inc, 3760 W. Belmont Ave., Chicago 18, Ill.

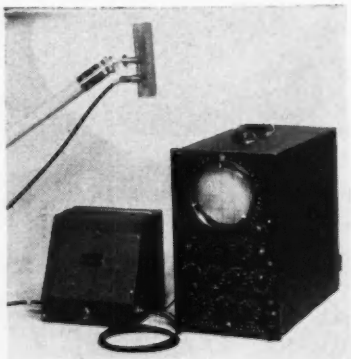


Insulated Wire

A new glass-braid-lacquered wire with silicon rubber insulation is being produced. Sil-X is designed to retain its flexibility at −60F and maintains its physical and electrical properties as high as 400F. Other advantages claimed are high resistance to flex cracking, low dielectric constant, and fungus resistance.

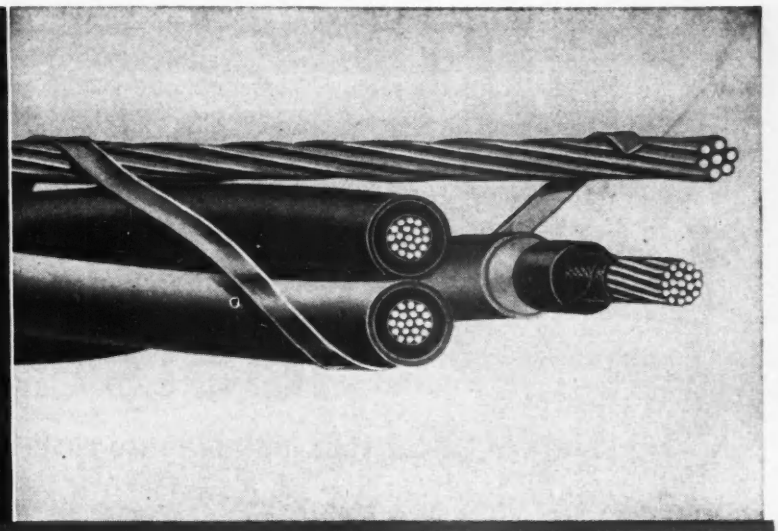
Six sizes of wire have been approved for use in lighting fixtures up to 200C. The company recommends its use for oil and gas fired furnace control equipment.

Essex Wire Corp, Fort Wayne, Ind.



Corona Detector

A new device for detecting surface corona discharges in high-volt-



Durable neoprene jacket protects aerial cable . . . assures long service

Today, neoprene-jacketed, self-supporting aerial cable is first choice for primary distribution lines. Neoprene's outstanding resistance to deterioration from sunlight, weathering, and abrasion means maximum protection to insulation . . . long service without failure.

In rural, residential, and industrial areas alike, neoprene-jacketed aerial cables have continued to operate despite long exposure to conditions which would normally cause outages . . . such as the corrosive action of industrial smoke and fumes and abrasion by tree limbs. Ask your supplier about neoprene-jacketed aerial cable. It's available pre-assembled with built-in messenger or in individual cable lengths for "spinning" on the job.

NEOPRENE

The rubber made by Du Pont since 1931

DUPONT

REG. U.S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

FREE! **THE NEOPRENE NOTEBOOK**

Each issue describes interesting applications of neoprene . . . new products . . . on-the-job reports. Add your name to the mailing list. Just clip and mail this coupon to E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division EW-11, Wilmington 98, Delaware.

Name_____ Position_____

Firm_____

Address_____

City_____ State_____

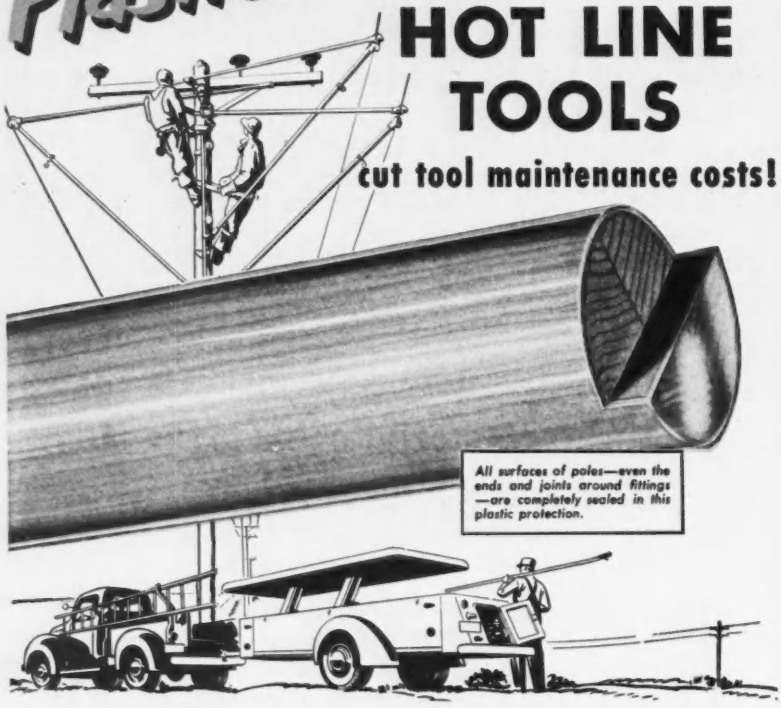
CHANCE

MAPLAC*

Plastic Protected

HOT LINE TOOLS

cut tool maintenance costs!



Now, Chance lightweight, aluminum-fitted Hot Line Tools are protected with a new super-tough plastic finish called "Maplac"* that greatly reduces tool maintenance and helps to keep tools in safe working condition.

This new plastic protection has many plus features of real value to hot stick users:

TOUGHNESS to withstand any impact or abrasive action encountered in normal use.

TRANSPARENCY that permits initial inspection and periodic checks.

MECHANICAL STRENGTH–Chance "Maplac," being extremely tough, does not require sacrifice of pole size and strength to gain the necessary thickness. It adheres to the wood surface and reinforces the pole adding to the factor of safety.

TEMPERATURE RESISTANCE–retains its toughness under widely varying temperatures.

ELECTRICAL RESISTIVITY– exceeds the voltage withstand tests of the wood insulation (complete safety, however, depends on the moisture content of the wood–no plastic will completely prevent absorption of moisture vapor).

MOISTURE RESISTANCE–Chance "Maplac" retards the absorption of atmospheric vapor in high humidity and protects the wood from precipitation moisture (this does not mean that plastic covered poles are recommended for use in the rain–but that Chance "Maplac" greatly reduces moisture penetration.

REPAIRABILITY–may be repaired without heat or special tools if cut by a sharp blow.

All this at NO INCREASE IN PRICE! Specify Chance "Maplac" Plastic Protected Tools.

* TRADE NAME

C52-4B

ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI

SAN FRANCISCO, CALIF.

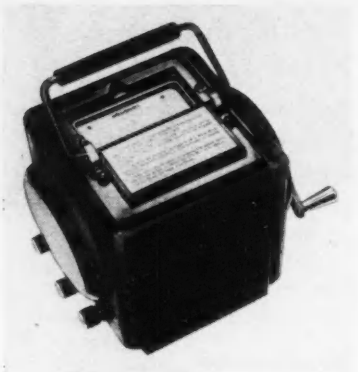
age rotating equipment has been announced. It is designed to increase safety factors by having all cable shields, metal fittings, and case at ground potentials.

Corona detector consists of a probe mounted at the end of a 10-ft insulating pole, a control box, and necessary connecting cables. The control box is connected to an oscilioscope for visual indication of corona.

The probe is a small capacitor covered with plastic. When it is placed near a corona source, variations in charge result in corresponding variations in the voltage on the probe electrodes. The variations are applied to a resonant circuit and cause it to oscillate momentarily. Pulse-type oscillations are then amplified and appear on the oscilloscope screen.

Operating power is furnished by a 67½-v dry cell and a 1½-v filament battery. Resonant frequency of the unit is 10 kc.

General Electric Co, Schenectady 5, N. Y.



Insulation Tester

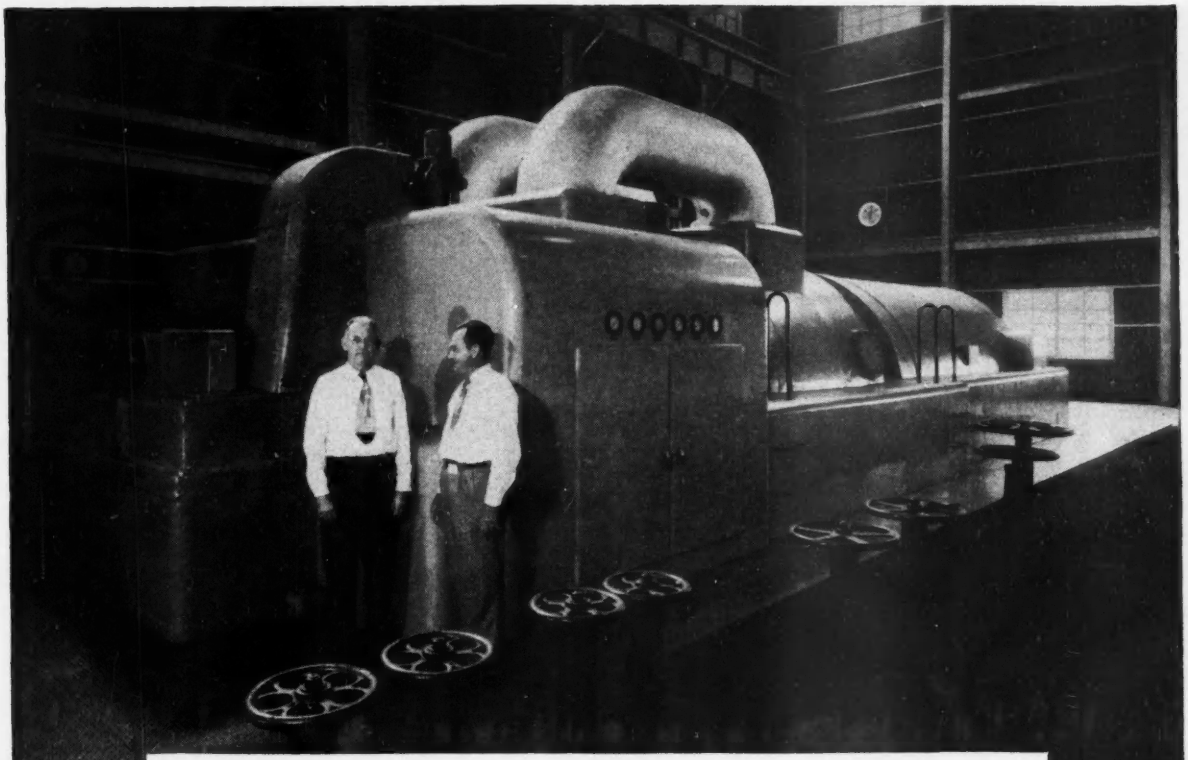
An improved self-powered resistance test set is available for testing insulation of medium- and high-voltage electrical equipment. Improvements include rugged casing and components, easier drive mechanism, freewheeling generator clutch, and separate Alnico magnets for indicator and generator. Model 5G-1000 is 500 v, self-powered, and reads to 1,000 megohms.

Winslow Co, Inc, 9 Liberty St., Newark, N. J.

Current Transformer

A new precision multi-range current transformer, Type P-5000, for

Typical of the many recently installed steam turbines lubricated with Gulfcrest Oil: 40,000 kw. Allis-Chalmers turbine at the Riverside Station of Gulf States Utilities, Lake Charles, La.



GULFCREST is the RIGHT oil for every steam turbine

the RIGHT base stock, Alchlor-processed

the RIGHT combination and concentration of additives

the RIGHT background of performance

Gulfcrest Oil has a background of successful performance in every type and make of steam turbogenerator.

In many of these installations the original charge of Gulfcrest has been in service more than 10 years with no significant change in its original characteristics, and with neutralization numbers always remarkably low and safe.

To get this kind of lubrication for your turbine, call in a Gulf Sales Engineer and ask him to recommend the proper grade of this superior oil for your turbine. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

Pittsburgh 30, Pennsylvania

GULF SERVES INDUSTRY

NEW

VERSATILE
LOW COST
FISHER-
PIERCE
SERIES
64400

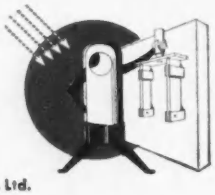
PHOTOELECTRIC CONTROL
FOR
OUTDOOR LIGHTING

The new Fisher-Pierce Series 64400 Photoelectric Control is a small, compact, lightweight 575 watt unit readily adapted to a great many mounting requirements. Appropriate accessories are available for mounting on luminaire, wood pole or cross arm, ballast, pole top, standard, mast arms, etc.

Because of its low initial cost as well as savings in wiring, other materials, and labor, it is economically feasible to use one F-P 64400 Control per lamp.

The control employs the well-known Fisher-Pierce basic circuit which has been proven by the experience of hundreds of utilities in thousands of installations. Such design improvements as etched circuitry have permitted low unit cost without sacrifice of high quality.

WRITE FOR DESCRIPTIVE LITERATURE

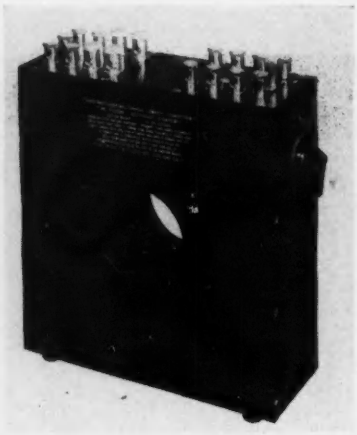


FP

The FISHER-PIERCE CO., Inc.
82 Pearl St., So. Braintree, Boston 85, Mass.

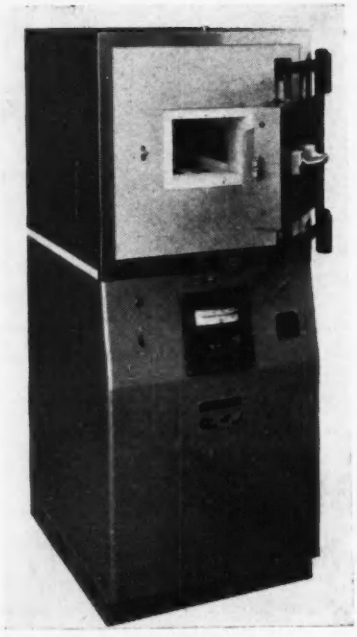
EXPORT: PHILIPS EXPORT CORP.
100 E. 42nd STREET
NEW YORK 17, N.Y.

IN CANADA:
NORTHERN ELECTRIC CO., Ltd.



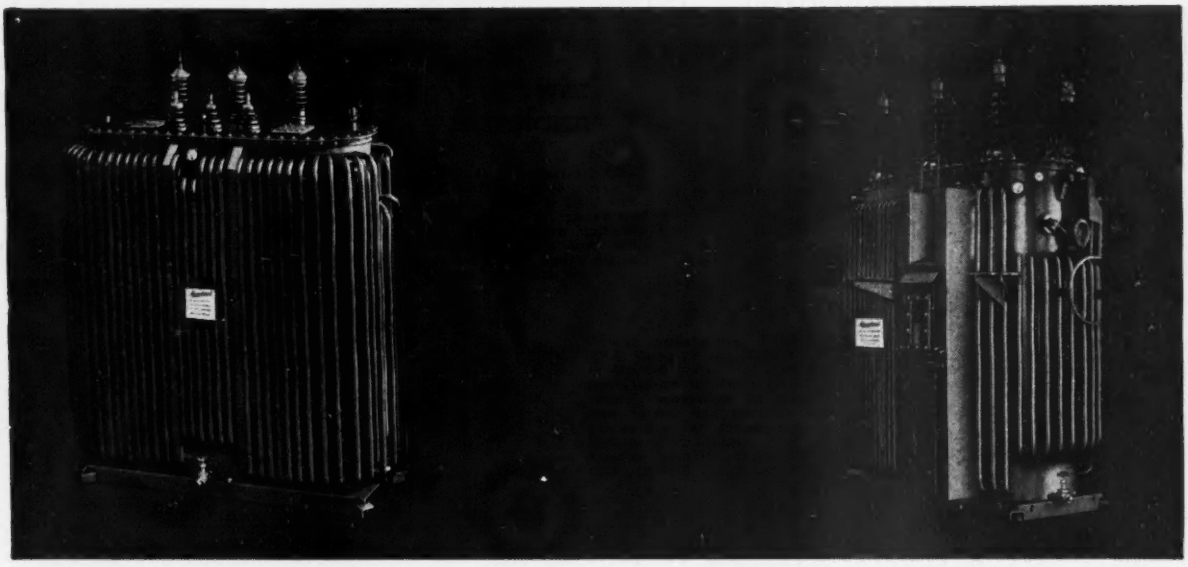
high and low voltage work has been announced. It is said to be good for testing other current transformers for ratio and phase-angle errors, and has current ranges from 5 to 5,000 amp.

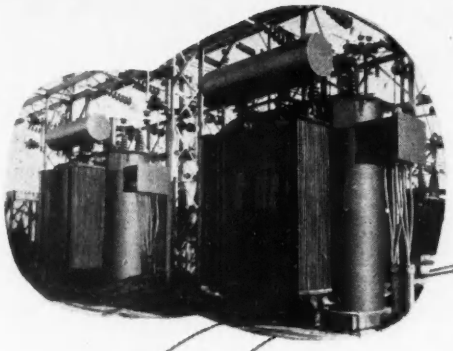
The P-5000 is furnished for a specified secondary burden from 0 to 25 va. With a secondary burden of 15 va, the ratio is said to be within 0.02% and the phase angle is within 1 min from 20% to 100% full-load current. **Electrical Facilities Inc, 4224 Holden St., Oakland 8, Calif.**



Electric Furnace

A new line of electric, box-type, heat-treating furnaces for temperatures up to 2,000F has been announced. They are built in five ratings





When dependability is a factor...

● Dependability in a transformer to you means trouble-free performance and long service life. To us, this means dependable construction.

For example, at STANDARD . . .

Tanks are built of rust-resisting steel, arc welded seams and tested under pressure. Liberal clearances are allowed from the windings and leads to tank and cover.

On the outside . . . attractive, long-wearing finishes with a primer coat and two finish coats of blue-gray enamel . . . on the inside, a lining of red oxide.

Covers are carefully and accurately fitted.

Tap changers and accessories efficiently placed with a specially designed tap changer switch.

These are just a few of the construction factors which STANDARD builds into Power Transformers. Look to STANDARD when you want dependability.

Everything Points To...

WRITE FOR BULLETIN CL-50

Tells the story with words and pictures of STANDARD'S complete line of transformers, and how they perform for every class of service . . . on the job.

Standard

THE STANDARD TRANSFORMER COMPANY

Trade Mark ●

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

GAI-TRONICS POWER PLANT COMMUNICATION SYSTEMS . . .

Prove that ENGINEERING and EXPERIENCE make the BIG difference!

CONSULTING

DESIGN AND ENGINEERING

FABRICATION

OPERATION

The *completely engineered* GAI-Tronics power plant communications system is designed and built by men associated with the design, construction, and operation of power plants throughout the world. Their "know-how" insures the solution to your power plant communication problems.

Two-way or group conversations can be carried on over telephone-type handsets and sound projectors *without* using special booths. The projectors can be used for paging and issuing emergency instructions. If you desire, telephone-like privacy may be had with the flick of a switch even though the system remains alerted for emergency use. The completely engineered GAI-Tronics system can be installed by *your* maintenance men. With a GAI-Tronics system, your power plant is equipped with a custom-designed, internal communication system that is easy to install; easy to operate; easy to maintain. A GAI-Tronics power plant communication specialist will be glad to discuss your communication problems.

GAI-TRONICS
CORPORATION
READING, PA.

GAI
FOUNDED 1946

A SUBSIDIARY OF
GILBERT ASSOCIATES, INC.

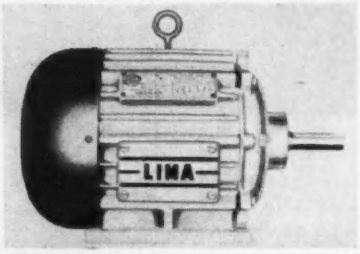
FREE!

A booklet—Power Plant Communication Systems—or a convincing demonstration in your plant. The portable GAI-Tronics system designed by our engineers for this specific purpose can be scheduled for your plant upon request without obligation. Write today. Dept. G-T.

ranging from 2 to 12 kw with inside furnace dimensions from 6 x 6 x 9 in. to 8 x 10 x 18 in.

Furnaces are designed with a skirt-type cabinet and are furnished complete with a transformer, contactors, switch box, and electric indication temperature controller. Heating elements are made of high-temperature alloy wire, which is said to be non-scaling, non-flaking and practically impervious to attack from sulphur.

K. H. Huppert Co, 6830 S. Cottage Grove Ave., Chicago 37, Ill.



Motors

A new line of totally enclosed, fan-cooled motors, Type E, in NEMA frame sizes 224 to 326 inclusive has been announced. The motors are available in ratings of ¾ hp at 900 rpm to 20 hp at 3,600 rpm, two or three phase, all standard frequencies, and commercial voltages below 600 v. Features claimed for the new line include:

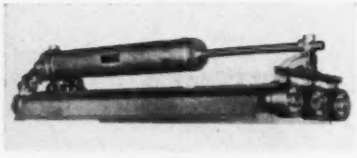
1. Rigid, seasoned cast iron frames with integral feet.

2. Deep, integrally cast fins providing extra heat dissipating surface.

3. Double-width prelubricated sealed ball bearings.

4. And a specially designed cast aluminum fan for cooling.

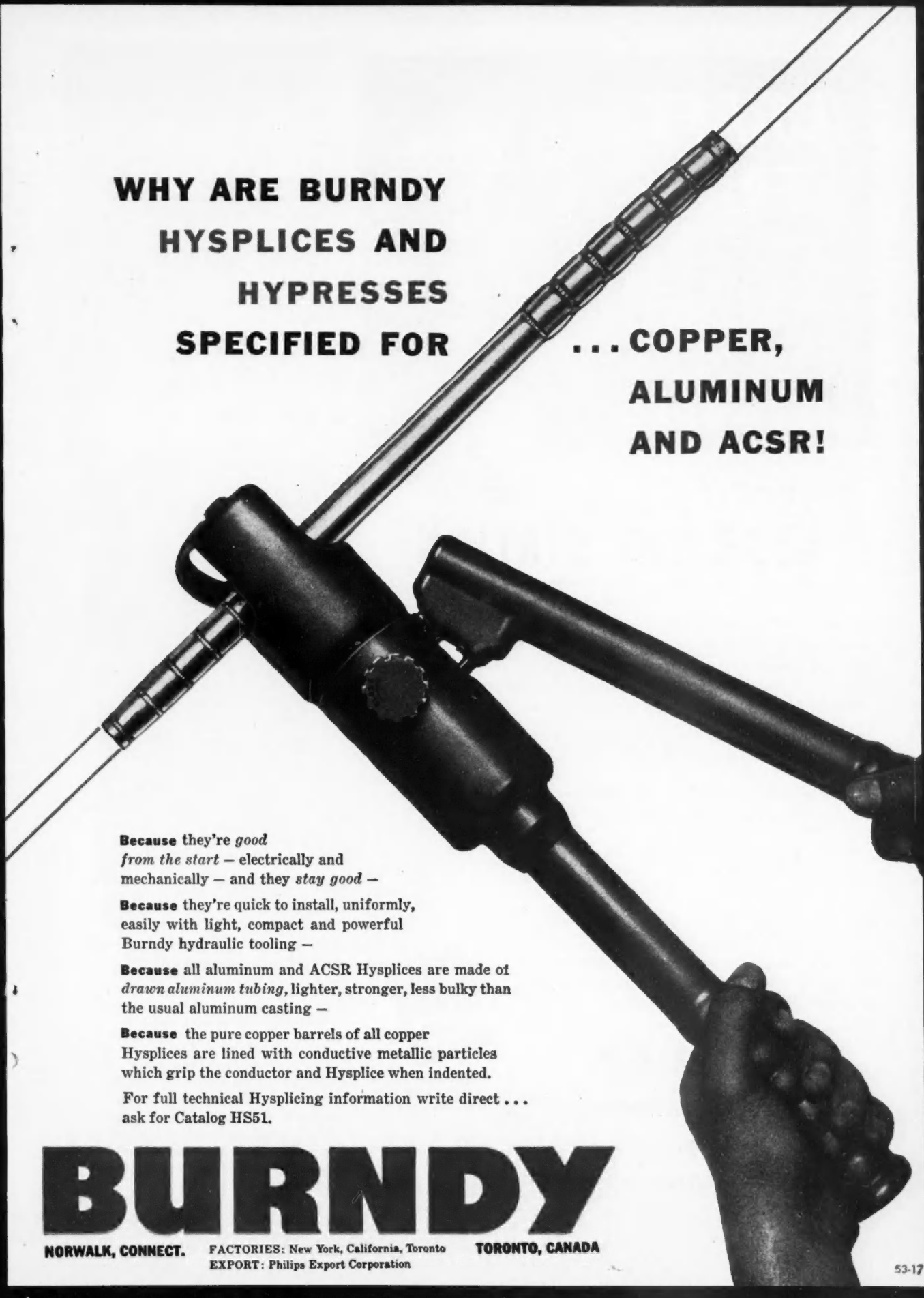
Lima Electric Motor Co, Lima, Ohio



Lighting Fixture

A new explosion-proof and dust-tight fluorescent lighting fixture has been announced. Its fluorescent tubes are housed in an individual tube of heat resisting glass. Tube ends are reverse tapered and sealed into cast

WHY ARE BURNDY HYSPLICES AND HYPRESSES SPECIFIED FOR ... COPPER, ALUMINUM AND ACSR!



Because they're *good from the start* – electrically and mechanically – and they *stay good* –

Because they're quick to install, uniformly, easily with light, compact and powerful Burndy hydraulic tooling –

Because all aluminum and ACSR Hysplices are made of *drawn aluminum tubing*, lighter, stronger, less bulky than the usual aluminum casting –

Because the pure copper barrels of all copper Hysplices are lined with conductive metallic particles which grip the conductor and Hysplice when indented.

For full technical Hysplicing information write direct ... ask for Catalog HS51.

BURNDY

NORWALK, CONNECT. FACTORIES: New York, California, Toronto **TORONTO, CANADA**
EXPORT: Philips Export Corporation

53-17

DRAFT FANS GO on GREEN

as at the

ALBRIGHT STATION*

Monongahela Power Company
Fairmont, West Virginia

Units #1 and #2 are in operation. The fans for Unit #3 have been designed and are being constructed. They will be larger than the fans for the first two units. Boiler #3 will operate on the same type of fuel (pulverized coal) and is expected to generate one million pounds of steam per hour.

Each boiler now in service is served by two Forced Draft and two Induced Draft Fans with the following specifications:

F. D. Fans Double inlet with radial inlet vanes; outlet dampers; rain hoods and recirculating duct connections. Capacity for each fan: 110,500 cfm; 100 F; 14.7" SP; 1180 rpm; 348 hp.

I. D. Fans Double inlet, special control type inlet dampers and outlet dampers. Capacity of each: 187,000 cfm at 350 F; 13.5" SP; 880 rpm; 566 hp.

Green Fans can show an excellent record of efficiency and durability. They can be found in many of the leading and recently completed utility and industrial power plants. They have back of them a fund of knowledge about fan requirements and fan design. They serve their users well.

*Sanderson & Porter, Engineers

Our Catalog No. 168 tells all about Green Fans. Write for a copy.

THE GREEN *Fuel Economizer* COMPANY INC.

- Economizers
- Fans
- Air Heaters
- Cinder traps
- Aerodyne Dust Collectors

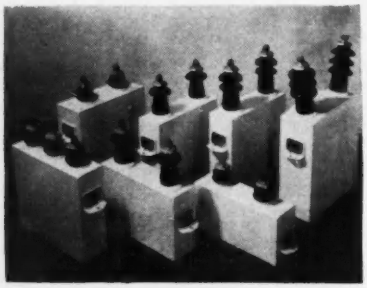
BEACON 3, NEW YORK

aluminum housings, which contain the lamp receptacles.

Receptacle housings at the ballast ends are pivotally connected to the ballast housing. At relamping ends, the receptacle housings are fastened to a supporting stem assembly that attaches to the ceiling. Reflectors are sheet metal with white enameled interior and aluminum finished exterior.

The fixtures may be placed end-to-end. A link member that is part of the supporting stem assembly allows the relamping end of the fixture to be lowered several inches for easy access. When this is lowered and the threaded receptacle covers removed, lamp receptacles and mounting plate assemblies are exposed.

Crouse-Hinds Co, Syracuse 10, N. Y.



Capacitors

An improved line of Inerteen distribution capacitors for application in high and low temperatures is available. Capacitors can be used at temperatures as low as —40F. They will reportedly operate at or above 104F without excessive losses, corona, aging, or permanent change in efficiency.

Improved line was made possible by coordinating internal design with a change in composition of the dielectric fluid. Solder-sealed bushings and zinc spray finish further insure trouble-free operation.

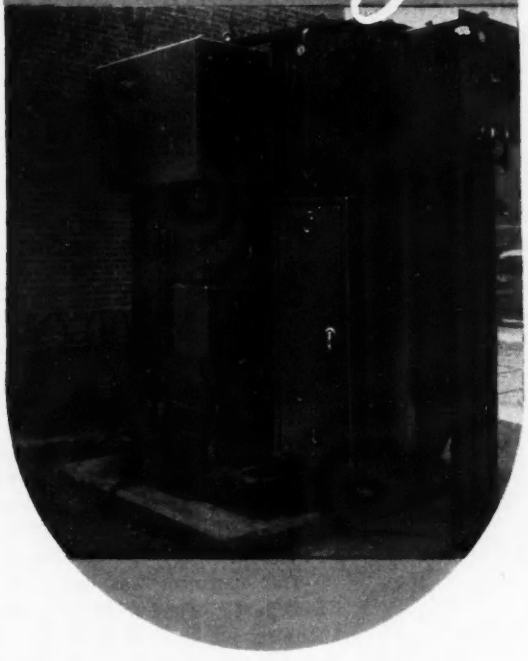
Westinghouse Electric Corp, 401 Liberty Ave., Pittsburgh 30, Pa.

Varnished Glass Cloth

A new varnished glass cloth, called A-Glass, has been announced. It is claimed to withstand high temperatures, provide high thermal heat dissipation and heat resistance, and has high tensile strength. A-Glass is available in rolls, sheets, or tape.

Sun Chemical Corp, 113 E. Centre St., Nutley 10, N. J.

PENNSYLVANIA LOAD RATIO CONTROL EQUIPMENT OPERATES *Quietly*



2500 Kva, 3 Phase, 60 Cycles,
11700 Delta — 2400 Delta/4160Y volts.

Manufacturers of Load Ratio Control Equipment have long concentrated their attention on designing a snap action tap changer mechanism that would operate quietly.

Pennsylvania tackled this problem a number of years ago and in 1949 perfected the *Silent Snap Switch.* Millions of "in the field" operations have verified its sound design principles and fine construction.

The Silent Snap Switch moves swiftly and quietly in response to the demands of the automatic control mechanism. Voltages are raised or lowered in comparative silence.

High among the advantages of quiet tap changing operation are the following:

1. less wear and tear on the equipment;
2. no breakdowns from mechanical impact;
3. longer and more satisfactory tap changing mechanism life.

Quiet Load Ratio Control transformers are especially desirable for installation in residential areas where undue noise, and the clanging and banging formerly associated with the operation of underload tap changing equipment are extremely objectionable.

Pennsylvania Load Ratio Control transformers with the Silent Snap tap changing action are available in sizes up to 7500 Kva and in all voltages.

For complete information, write Pennsylvania Transformer Company, Canonsburg, Pa., and ask for Catalog 5112.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division • Canonsburg, Pa.

LETTERS TO THE EDITOR

Chilean Con Niption

To the Editor:

On page 21 of your Sept. 14 issue you showed a picture of the penstock of our Los Molles power plant in Chile. We were very pleased to notice the interest shown by your publication in one of our works.

We believe, though, that for the purpose of judging the importance of the type of structure such as a penstock, a reference as to the comparative head or pressure would have been more objective. As for the pipe diameter (30 in. maximum), length (7,900 ft), or total tonnage (800), which are not very impressive, we doubt that it would be "second largest in Latin America." On the other hand, we can state that the total head of this penstock (3,800 ft) is the highest in the Americas, and, as far as we know, the tenth highest in the world today.

We should like also to point out that the whole penstock is made of steel. It was purchased in the U. S., shipped in lengths of 40 ft, and welded in site.

Raul Saez S., Chief
Department of Works
Empresa Nacional de Electricidad S.A.
Santiago, Chile

Switching the Dial

To the Editor:

To get both sides of this dial design proposition before your readers, we'd be very happy to have our comments published.

The last item in your "Technical Notes," March 16, Electrical World, recommended white on black dials.

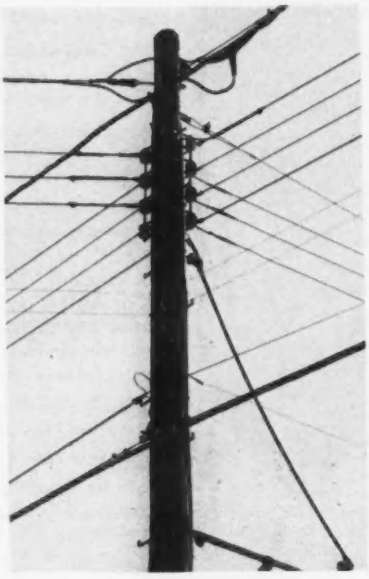
This is in agreement with our experience for a few specialized applications. White on black dials work out well in military aircraft and on shipboard—in submarines in particular—where blackout conditions are imposed. The purpose in these cases is to cut down the area of highest brightness and yet keep as high an illumination level as possible.

For more general and typical applications, it's the thought of our folks that black on white dials are preferable. There's never been any decisive visibility advantage shown for them but they do allow for better overall seeing conditions.

With a white on black dial, the average "integrated" brightness of the face is often less than that of the surrounding panel—and we know definitely that this is not a good seeing condition. When a black on white dial is used, the meter face is somewhat brighter than that of the panel. The white dial face makes any mirror action of the cover glass less noticeable and commands more attention.

White on black dials permit the use of higher reflectance, more attractive and colorful finishes on the panel boards. The combination provides high visibility of the meters, a comfortable brightness balance between the meters and the panels, and an attractive relationship between the panels and other interior surfaces which are being made lighter and more colorful.

Bob Oetting
Lamp Division
General Electric Co.
Cleveland, Ohio



Too Much Spaghetti?

To the Editor:

We are very much interested in the article by Fred Sciotti on aerial cable (EW, Oct. 19, p. 114). This is the only answer where loads cannot pay for underground.

The aerial primary and telephone cables certainly look neat and solid, but what is all that fanned out between these cables? Inductive drops and shorts can happen there, too.

Frank W. Chapman
Electrical Engineering Consultant
Greenwood, S. C.

Young Enthusiasm

To the Editor:

Your observations about Harold Young are excellent, but you might have brought out one or more qualities of his which make him a safe man to deal with from an investor's viewpoint.

He does not get unduly excited or depressed about the fortunes or misfortunes of companies. He looks at the facts, such as management, territory, and finances, and weighs them expertly.

His approach to companies having temporary difficulties is sympathetic, not critical. Consequently, I may safely state he is well received by them, and they appear to be always willing to inform him about them and how they expect to work out of such difficulties.

The vision he has displayed over the years I have known him proves he can see farther and deeper than most persons.

Raymond H. White
Woodmere, N. Y.

Author Rights Himself

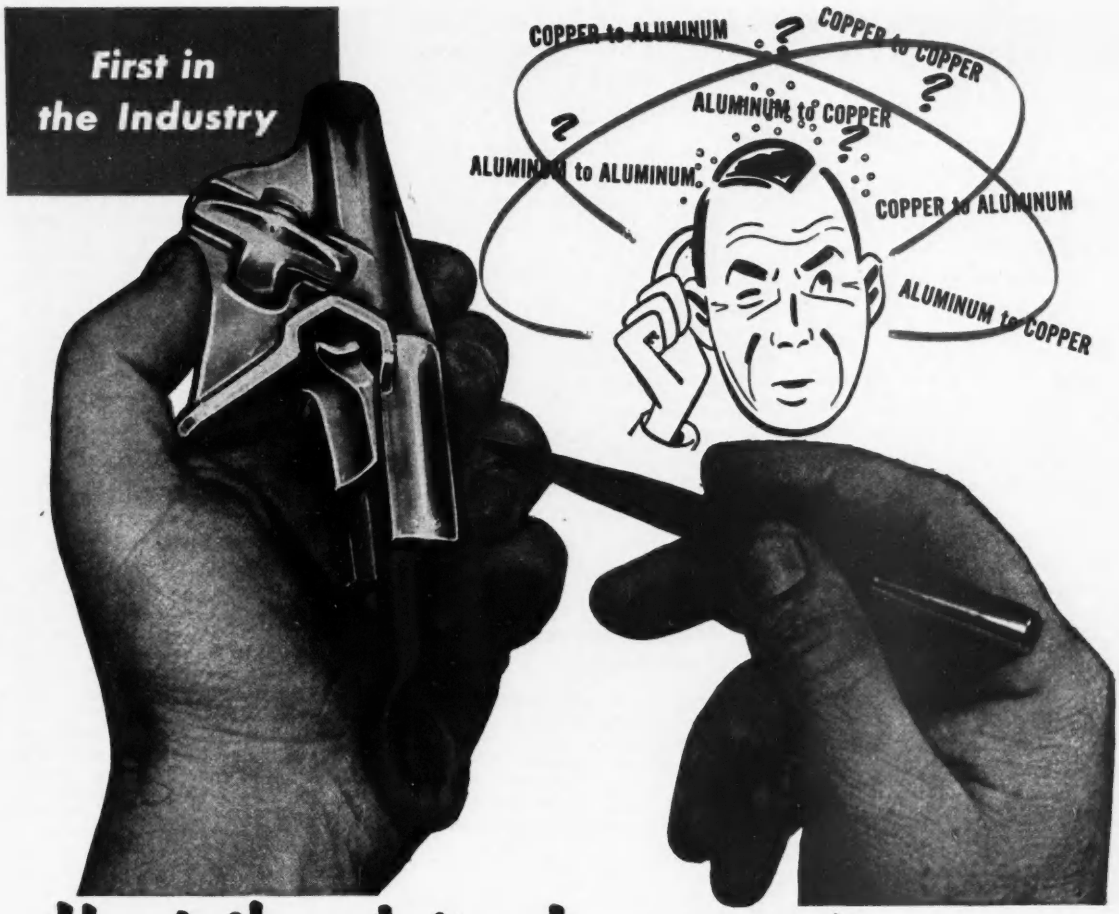
To the Editor:

On page 87 of the July 27, 1953 issue of Electrical World, I stated that the National Electrical Code would permit a 15-amp motor load on a No. 14 circuit.

This statement was based on information obtained from outside sources, but is incorrect and I am advised that no such change in the rules is contemplated.

I would appreciate your publishing a correction along with my apologies for having included it in my article on the problems with room coolers.

F. G. Hammer
Southern Services, Inc.
Birmingham, Alabama



Here's the solution! AGP*...

Keeps all tap connections TROUBLE FREE

Chance Aluminum General Purpose Clamps solve the tap connection dilemma—eliminate confusion and the possibility of error in connector applications—reduce inventories—and greatly simplify stocking problems.

These new Chance multi-purpose tap clamps are the result of a newly-developed method of coating aluminum with a high-density fortified cadmium, which wards off corrosion and electrolysis in all types of connections.

The strong cast aluminum bodies are light in weight—easy on the conductor because they reduce conductor fatigue—easy to handle on a clamp stick. Contacts stay tight—the thermal expansion of the clamp is uniform with aluminum conductor . . . and since the thermal coefficient of copper is less than that of aluminum, the clamp will not deform copper conductor even under extreme temperature variations. The conductor is protected at all times.

Available in both the PC (Protected Connection) and Perma-Grip designs.

CHANCE *Aluminum General Purpose**

The Tap Clamp with the RED Eye Screw

C53-5A

ABC INDUSTRIES

Customer test-proved in field and laboratory to surpass all others

A. B. CHANCE COMPANY • CENTRALIA, MO. • SAN FRANCISCO, CALIF.

WHAT THEY'RE SAYING

At Industry Meetings

Figures Don't Tell Whole Utility Story

ELMER L. LINDSETH, president, Cleveland Electric Illuminating Co at Great Lakes Security Analysts Conference, Cleveland, Ohio

There are many facets of the outlook for power and especially the outlook for one power company as compared with another that do not lend themselves easily to statistical analysis.

And yet they deserve the attention of the analysts, more attention I think than they customarily get.

Statistics are important, certainly. But they aren't enough. Debt ratio and depreciation accrual rates and dividend pay-outs are important. But they tell largely what happened yesterday, not what's going to happen tomorrow.

The future of the electric power business will be determined by people. The kind of managers they are, the kind of motivation they receive, the tools they use, and the foundations they have to build on—these will determine how well our industry, and individual companies within it, will make out.

Farm Chore Load Offers Huge Potential

WALTER H. SAMMIS, president, Edison Electric Institute at National Farm Electrification Conference, Washington, D. C.

An interesting farm study was that carried out in 1949-50 by the Central Illinois Light Company in DeKalb County, Illinois, in cooperation with the University of Illinois. The prime purpose was to study the characteristics of the present and potential farm electric load as a guide to future planning by the company's engineering and sales organizations.

These two important conclusions were readily apparent from the survey:

- The greatest use of electricity today is in the farm home.
- The farm chore load offers the greatest potential for future electric business.

Saturations of refrigerators, electric ranges and water heaters were found to be 100, 73 and 63% respectively. Farm chore equipment, with the exception of milking machines and water systems, showed less than 50% saturation. The survey indicated that the use of hay dryers, barn conveyors, feed grinders and similar equipment would boost average annual farm consumption of electricity to 12,000 kwhr.

Another thing learned was that even on the best farms the lighting was substandard. Whether this belongs in the realm of research or education, it is another job where the utility should take the leadership. As a result of its numerous findings, extension of the DeKalb research project to other utility areas might prove profitable to the companies as well as to their customers.

Farm Research Needs Help of All Factions

CLYDE T. ELLIS, executive manager, National Rural Electric Cooperative Association, at National Farm Electrification Conference, Washington, D. C.

In research there are no factions—no one way, no political parties or divisions. In this area we can draw together in faith and trust.

However, research, legislation for research, and development of farm electric equipment is not enough. For unless there is an alert farm audience—an eager farm equipment-using public, then research will hold fast the peculiar reputation it has in the minds of some—high-powered brains wasting time in musty labs producing useless conclusions. We know that this is not the case, and so we have been especially concerned about getting the story told.

When the giant manufacturer and the distributor work with the small town dealer and service outlet, and in turn, with the power supplier, whether commercially owned or cooperatively owned, and when the state and national organizations representing these groups join in with the active assistance of the REA, we will have reached a high point in effectiveness.

A committee has been doing work on this plan and shortly there should be concrete evidence of its effectiveness. Joint advertising programs and educational activity immediately spring to mind, including selling and promotional campaigns that meet the highest standards.

Electrical Applications of Aluminum

Automatic Door Openers

Aluminum is now being used in many automatic door opener mats for commercial doorways. Aluminum sheet is sheared, pierced and short lengths of aluminum EC wire riveted to it. When assembled into the mat, the weight of even a small child stepping on the mat brings the sheet and wire into contact to complete an electric air valve circuit. This allows compressed air to enter an actuator mechanism mounted above the door, thus causing the door to open. Aluminum is ideal for this application because of its high electrical conductivity and because it is not subject to reduction by atmosphere attack. Also, aluminum is easy to fabricate, a factor that means lower costs to the manufacturer. Aluminum's light weight is an advantage in shipping and installing the equipment.

Protective Conduit

Aluminum conduit is being widely used in diesel-electric locomotives as well as in many other types of equipment for enclosing electric conductors carrying current to traction motors, auxiliaries, lights, etc. Aluminum is popular for this use primarily to cut deadweight and to eliminate corrosion problems. Use of aluminum eliminates the need for a protective coating, thereby simplifying installation and reducing maintenance costs to a minimum.

Write to Reynolds Metals Company at the address on the facing page for more complete information on the subjects above and also for details on the many other electrical applications of aluminum.

REYNOLDS ACSR and REYNOLDS ELECTRICAL ENGINEERING SERVICE both ON THE JOB WHEN NEEDED

When field consultation is desired, Reynolds engineers are available to meet with your construction engineers right on the job site. There are many examples of this part of Reynolds Electrical Engineering Service. For instance, a Reynolds engineer recently assisted an Oklahoma company* in stringing conductor and overhead ground wire over a difficult river crossing. Another Reynolds engineer worked with a Kansas company* advising the contractor on correct ACSR stringing practices. In a third case, a Reynolds engineer went out on the job for a Missouri company* to review stringing practices and to advise engineers regarding cable behavior under various service conditions. These are typical of the countless on-the-job service calls made by Reynolds engineers.

The experienced help of Reynolds Electrical Engineering Service is available without cost to Reynolds cable customers. This service, plus the savings in original cost, handling costs and field costs offered by Reynolds ACSR, make a combination that is well worth looking into. *Remember—Reynolds engineers will also be glad to conduct a meeting with your men and present design and fabrication information on all phases of electrical application for aluminum.*

*Names on request

4 REYNOLDS MASTER REELS DO THE WORK OF 100 WOODEN REELS! Handle ACSR quicker, more economically. Eliminate reel inventory and exchange. Cut down on handling, storing, record-keeping—reduce damage cost to a minimum. Reynolds Master Reels and Coils are easily assembled by linemen right on the job.

For information on specific problems see your Reynolds distributors listed below, call the nearest Reynolds Office or write direct. Reynolds Metals Company 2584 South Third Street, Louisville 1, Kentucky

A. A. Electric Supply, Chicago • California Electric Supply, San Francisco
General Electric Supply Co., Bridgeport (and branches) • Gough Industries, Los Angeles
Hendrie & Bolthoff, Denver • Hughes Electric Supply, Orlando
The Korsmeyer Co., Lincoln, Nebr. • Maydwell & Hartzell, Inc., San Francisco
Perry Sankie Co., San Antonio • San Antonio Machine & Supply Co., San Antonio
Southern Electric Equipment Co., Atlanta • Chas. L. Ward Co., Kansas City, Mo.
Westinghouse Electric Supply Co., New York City (and branches)
Williamson Sales Co., Shreveport, Dallas and Houston

See "Mister Peepers" Sundays NBC-TV. Consult local listing for time and station.

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

Saves time...money

All steel from one source

When you combine all your steel requirements on a single order to Ryerson you cut costs in many ways. One call—one order—save purchasing time and you also simplify bookkeeping—reduce clerical expense.

In addition, combining most carbon steel purchases under the Ryerson quantity differential plan brings further savings. And with larger quantities you often effect substantial reduction in freight on long hauls.

All these economies are possible when you call Ryerson for steel because Ryerson stocks are the world's largest and most diversified. Carbon steel, alloys, stainless—no matter what analyses you need, no matter what shapes and sizes, you can be practically certain of getting them all with just one call to Ryerson.

You can be sure of prompt delivery, too. So next time you need steel, no matter how many kinds or sizes, call your nearest Ryerson plant.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled & cold finished
STRUCTURALS — Channels, angles, beams, etc.
PLATES—Many types including Inland 4-Way Safety Plate
SHEETS—Hot & cold rolled, many types & coatings
TUBING—Seamless & welded, mechanical & boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
REINFORCING—Bars & Accessories, spirals, wire mesh
BABBITT—Five types, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND • DETROIT
PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

NEWS ABOUT PEOPLE

NEES Announces Executive Changes

NEWELL A. CLARK

Clark heads two new subsidiaries. Holcomb, Costello, and Pulsifer elevated

With the establishment of Essex County Electric at Salem, Mass., and Suburban Electric Co at Malden, Mass., New England Electric System has announced the following executive appointments:

Newell A. Clark, formerly president of Malden Electric Co, is now president of both Essex County Electric and Suburban Electric. The latter company was formed as the result of the merger of Suburban Gas & Electric Co, Revere, Mass., and Malden Electric.

H. SHERMAN HOLCOMB

New Vice Presidents . . . H. Sherman Holcomb has been named a vice president of Essex County Electric, which was established to take over Salem Electric Lighting Co, Gloucester Electric Co, and Beverly Gas & Electric Co. Holcomb served the latter New England Electric System subsidiaries as vice president.

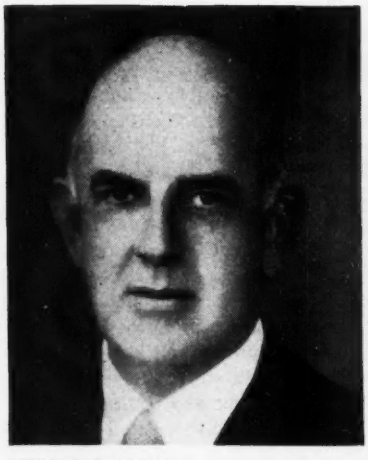
John T. Costello has been appointed a vice president of Essex County Electric and Oliver T. Pulsifer has been made a vice president of Suburban Electric.

NEES Veteran . . . Clark began his career with NEES in 1921 as station foreman for the Fall Mountain Electric Co, Bellows Falls, Vt., becoming manager in 1926. Three years later he became assistant general manager of the Narragansett Electric Co, Providence. From 1930 to 1934 he was general manager of the Quincy Electric Light & Power Co. Later he became North Central district manager at Leominster and manager of the Western district at Northampton. In 1950 he moved to Malden as principal officer of the system's Mystic Valley and North Shore companies. In 1952 he was elected president of Lowell Electric Light Corp, Haverhill Electric Co, and Amesbury Electric Co, and vice president of Lawrence Gas & Electric Co, all NEES subsidiaries.

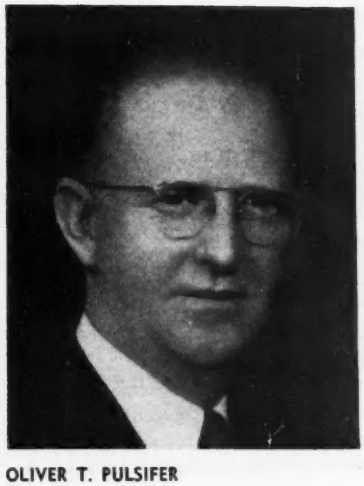
Holcomb, who entered the utility field in 1926, worked with Fitchburg (Mass.) Gas & Electric Co before going in 1929 as superintendent to Gloucester Electric. In 1936 he was made an executive assistant with the New England Power Service Co, Boston. Six years later he was appointed assistant to the president of system companies in the Mystic Valley area, and in 1944 assistant district manager and vice president of the companies north of Worcester. He assumed the post of vice president in 1952.

Costello started his utility career with Malden Electric and joined Suburban G&E in 1924. Most recently he served as manager of the Gloucester Electric.

Former Manager . . . Pulsifer, who joined Malden Electric in 1915, was made assistant storekeeper in 1938 and general storekeeper in 1944. Two years later he became assistant to the manager of Malden Electric and manager in 1949.



JOHN T. COSTELLO



OLIVER T. PULSIFER

Van Derzee Is Elected New President of AEIC

New president of the Association of Edison Illuminating Companies is Gould W. Van Derzee, president of Wisconsin Electric Power Co. Van Derzee, formerly a vice president of the association, succeeds Justin R. Whiting, board chairman of Consumers Power Co.

Van Derzee has been associated

MODERN
in Every Way . . .
ROYAL VERTICAL AIR BREAK SWITCHES

Simple, reliable design with a minimum of moving parts. Only 21 separate parts above the insulators.

Beryllium copper contact rods greatly increase the conductivity. After 2400 operations, rods show no wear.

Royal Electric's newest model type VVL air break switch incorporates the latest advances in the industry—Beryllium copper contact rods, high pressure point contacts, permanently sealed lifetime bearings, and fault-compensating high pressure contacts. The VVL means reliability.

Advantage is taken of electro-magnetic repulsive forces to increase contact pressure during high current-periods, particularly so during fault-current.

High pressure contacts at both hinge and front ends. At the hinge end, contact fingers permanently engage the contact pin providing continuous annular contact. The first switch to eliminate braid shunts in its design (1937).

Aircraft type sealed ball bearings packed with Silicone grease provide operation to -60 deg. F. and freedom from maintenance.

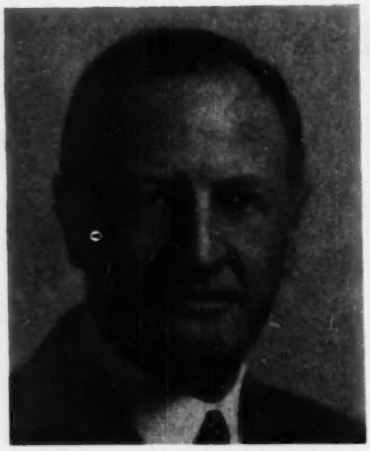
For engineering data on the full line of switchgear, connectors and substation fittings produced by Royal, write for a copy of our new Catalog No. 12.

Royal

A Part of the Arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET Chicago 19, Ill.

Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices



GOULD W. VAN DERZEE

with Wisconsin Electric Power and a predecessor company since 1913. He became assistant general manager in 1918, vice president and assistant general manager in 1925, vice president and general manager in 1934, and president of the utility in 1945.

In addition to his responsibilities as president of Wisconsin Electric Power, Van Derzee also serves as president of Wisconsin Michigan Power Co, Wisconsin Natural Gas Co and Milwaukee Electric Railway & Transport Co, all subsidiaries of Wisconsin Electric Power.

The new AEIC head is a past president of the Wisconsin Utilities Association and a member of the board of directors of Edison Electric Institute.

•

John Asher, former director of the Northeast Area of the Rural Electrification Administration, has been named assistant manager of Choptank Electric Cooperative, Denton, Md. He had been with REA for 18 years.

Alden E. Calkins has been appointed as publicity and public relations representative of Stone & Webster, Inc, and affiliated companies. Calkins will make his headquarters in New York.

M. H. Hobbs has been named manager of Westinghouse Electric Corp's Switchgear Division to succeed **J. B. MacNeill,** who joins the staff of John K. Hodnette, vice president in charge of industrial products. **C. P. West** has been made assistant to the Switchgear Division manager and **A. A. Johnson** manager of the division's engineering department. Hobbs, who came to

ROOM FOR 5 MORE

CONDUCTORS

WHEN IT'S

ROCKBESTOS PNR

CONTROL CABLE

Both conduits are 1¼" D. But the one on the left carries 12-conductor PNR #9 AWG — 5 more conductors than the conventional 7-conductor #9 AWG cable below. That's because Rockbestos PNR is 46%* smaller in area. A better insulated control cable that saves you steel conduit, fittings and labor. Write for the full PNR story.

*Average determined by comparison with competitive control cable.

PNR 12-conductor #9 AWG in 1¼" conduit.

Conventional 7-conductor #9 AWG in 1¼" conduit.

ROCKBESTOS

PRODUCTS CORPORATION

NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO
PITTSBURGH • ST. LOUIS • LOS ANGELES
NEW ORLEANS • OAKLAND, CALIFORNIA • SEATTLE

Quick facts about

PNR

46% smaller area* . . . 28% smaller diameters*. Use smaller conduit and fittings, or put more conductors in present conduit.

Dielectric breakdown . . . over 40 times operating voltage.

Lighter and smaller. Easier to handle, store, ship, pull through conduit.

Flexible to —25°C (—13°F). No cracking!

Rated 600 volts . . . conductor operating temperature 75°C (167°F).

- Conductor doesn't have to be centered for accuracy, (toroidal wound transformer)
- Pocket-size, belt-mounting
- Covers 9 ranges
- Probe jaws completely insulated
- Test lead plug insulates itself when removed from meter
- No-rim window floods scale with light

only
AMPROBE
has these features!

AMPROBE "600"
0-15/30/60/150/300/600 amps A-C
0-150/300/600 volts A-C
$59.50 complete with cowhide case and voltage test leads.

AMPROBE "1200"
to 1200 amps A-C
$67.50 complete

AMPROBE "300"
to 300 amps A-C
$49.50 complete

Measures current instantly without interrupting service

PYRAMID INSTRUMENT CORP., LYNBROOK, N.Y.
(Export Div.: 458 Broadway, N. Y. Dept. EW-113
Cable: Morhanex)

AMPROBE®
the only pocket-size snap-around volt-ammeter

NEW!
AMPROBE *Junior*
VOLT-AMP TESTER

19.85 INCLUDING VOLTAGE TEST LEADS

PICK THE RANGE THAT FITS THE JOB:
Model "10": 0-10 amps AC. 0-125/250 volts AC.
Model "25": 0-25 amps AC. 0-125/250 volts AC.
Model "50": 0-50 amps AC. 0-125/250 volts AC.
Model "100": 0-100 amps AC. 0-125/250 volts AC.
Write for Catalog No. 132

Westinghouse's Switchgear Division in 1922 from Montana Power Co, was appointed assistant manager of the division in March of this year. West, who joined Westinghouse in 1926, formerly served as division engineering manager. Johnson began his career with Westinghouse in 1941 after 11 years of engineering work for the Consolidated Edison Co of New York, Inc. He has served since 1949 as manager of electric utility engineering for Westinghouse's industry engineering department.

John G. Kruse and **Richard L. Post** have been named assistant secretaries of Minnesota Mining & Manufacturing Co, St. Paul, Minn. Kruse, who joined Minnesota M&M in 1941, has been secretary of the company's executive committee since 1946. Post joined the company's legal department after his graduation from the University of Minnesota Law School in 1946.

H. E. Mahan, manager of General Electric Co's Illuminating Laboratory at Lynn, Mass., has retired after more than 43 years' service with GE's lighting and rectifier department. He is a member of the American Institute of Electrical Engineers and Illuminating Engineering Society.

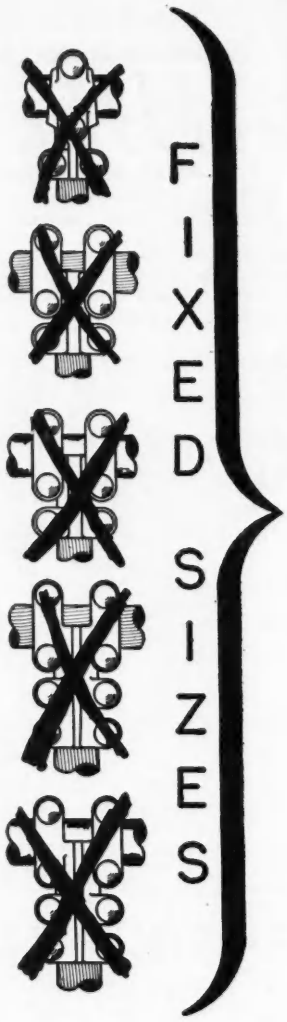
OBITUARY

Walter E. Olson

Walter E. Olson, 65, a vice president of Northern States Power Co, died recently at St. Paul, Minn.

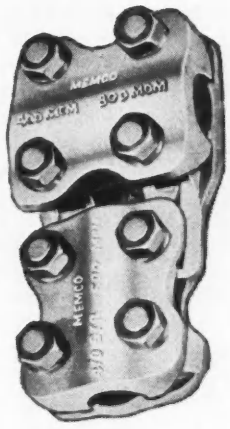
For the past 12 years Olson had been with Northern States Power, serving first as executive assistant to the president and later as vice presi-

SAVE COST AND MAN-HOURS

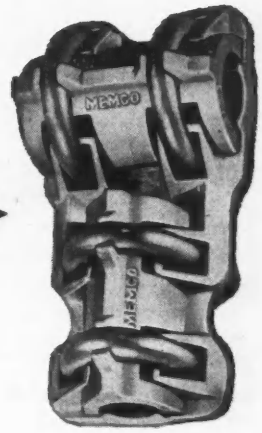


USE MEMCO *WIDE-RANGE* POWER CONNECTORS

STRAIGHT-BOLT → TYPE



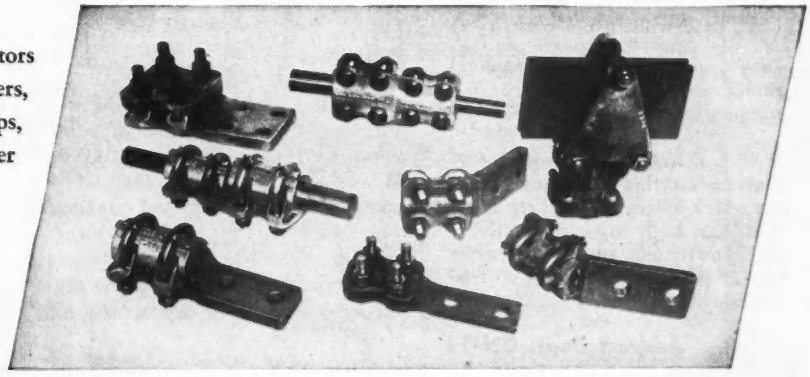
"U"-BOLT → TYPE



The NEW MEMCO wide-range electric power connectors span the entire range from #4 solid wire through 2000 MCM cable with only seven fittings. This saving in inventory costs, stockroom space and handling and engineering application constitutes a real advance. Either straight-bolt type or "U"-bolt type is offered to suit the buyer's choice. They are available for copper, aluminum or aluminum to copper combinations when so specified.

The MEMCO wide-range connectors are available in lugs, tees, couplers, stud connectors, bar tap-off clamps, etc. and can be used with either cable or tubing.

Write for Bulletin 521.



MEMCO ENGINEERING & MANUFACTURING CO., INC. • Commack, L.I., N.Y.

DOW CORNING
5 SILICONE COMPOUND

Repels Water
Protects
Lubricates
Insulates

Pole-Top Disconnect Switches

Proved effective as a switch lubricant; also as a release agent to keep switches operable under icing conditions.

Switch Clips, Hinges and Bearings

A mixture of zinc dust with Dow Corning 5 Compound serves as a lubricant and oxidation inhibitor. Zinc dust assures adequate conductivity. One application gives 2 to 3 years' protection.

ASCR Wire Splices

Applied to both the aluminum and steel conductors, compound flows under pressure around the spliced wires to fill voids, improve heat conductivity, exclude moisture and inhibit formation of oxide film.

5 kv Service Entrance Cable

Useful as a filling compound to prevent migration of water along rubber insulated 5 kv service cable when used without potheads.

Dow Corning 5 silicone compound remains stable at temperatures ranging from —70 to 400°F.

***WRITE TODAY* for more information on this compound and on other silicone products that: maintain high surface resistivity on insulators and electronic parts; preserve lineman's protective equipment.**

Address Dept. DN-11

DOW CORNING SILICONES

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

dent. Prior to joining Northern States Power, he was for six years secretary-manager of the North Central Electric Association, an organization representing utilities in Minnesota, Wisconsin, Iowa, North and South Dakota.

Before entering the utility field, Olson was active in Chamber of Commerce work, having been affiliated with the Chambers of Commerce in St. Paul, Mankato, Little Falls, and Minneapolis.

Stuart R. Williams, 55, vice president in charge of manufacturing and a director of the Holophane Co, Inc, New York, died Nov. 3 at Newark, Ohio. Williams, who joined Holophane in 1929, was made manager of the street lighting department in 1936, assistant works manager in 1941, and vice president in 1948. A member of the Illuminating Engineering Society, he was active for many years in the engineering society's Street Lighting Committee, serving at one time as its chairman.

Howard W. Leitch, 78, a retired vice president of Consolidated Edison Co of New York, Inc, died in New York Nov. 2. Leitch served with Consolidated Edison and its predecessors for 46 years. He became vice president in charge of electrical operations for the utility in 1938. After his retirement in 1941, he was a special consultant for the company.

Oren Reed, 57, construction engineer for the Tennessee Valley Authority, died Oct. 29 in Chattanooga, Tenn. Reed, who joined TVA's engineering staff in 1934, served successively as construction engineer on the Watts Bar Dam, Fontana Dam, Watauga Dam, and Widow's Creek plant projects.

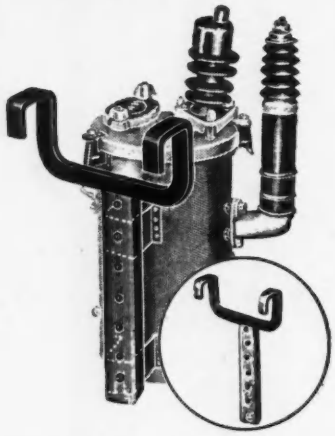
Gaston F. DuBois, 73, board member and former vice president of Monsanto Chemical, died in St. Louis, Mo., Nov. 1. DuBois joined Monsanto Chemical in 1904 and remained with the company until his retirement in 1945. For 21 years he was a vice president, directing technical production, research and development for Monsanto Chemical.

John W. Gilmour, 80, former treasurer of the Hydro-Electric Power Commission of Ontario, died recently in Toronto, Ont.

TRANSFORMER HANGERS

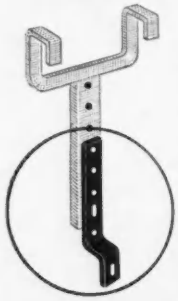
LOOK FOR THE NAME
THIEL
It's a Mark of Quality

Formed from heavy gauge steel . . . hot-dip galvanized for longer life. Available in two sizes. Designed to meet NEMA specifications.



Model	1-Phase	3-Phase	Weight
T-1	3-15 KVA	9 KVA	16¼ lbs.
T-2	25-37-50 KVA	15-45 KVA	27¼ lbs.

HANGER KICKERS



Model K-1 for use with T-1 hanger. Adjusts to four positions. Model K-2 for use with T-2 hanger adjusts to five positions. Kickers and bolts are hot-dip galvanized.

Hangers and Kickers in Stock

THIEL
TOOL AND ENGINEERING CO.
1417 NORTH MARKET ST.
ST. LOUIS 6, MISSOURI

6 Reasons why you get greater accuracy with Bristol Series 500

RECORDING VOLTMETERS AND AMMETERS

1. Low burden—the lowest burden of any round-chart recorder on the market.

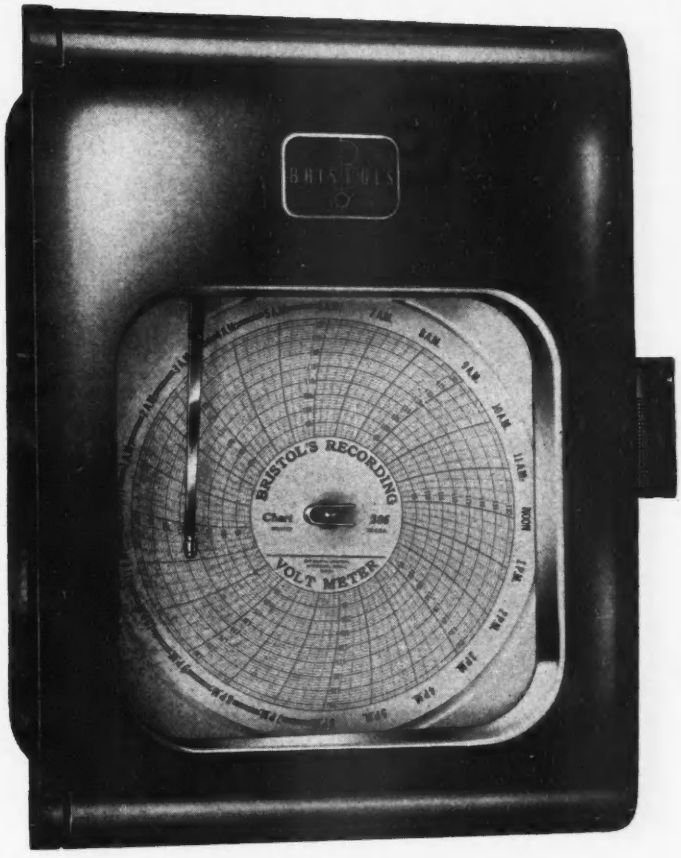
2. Extremely high torque gradient.

3. Temperature compensated.

4. Shock-proof moving element mounting.

5. Leveling of instrument not critical.

6. Continuously legible recording on sudden changes—up to full scale value.

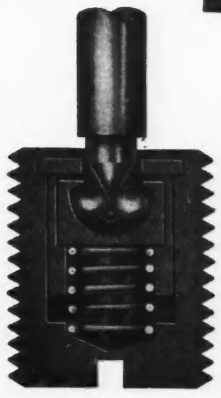


Bristol Recording Voltmeters and Ammeters use moving-iron measuring mechanisms, known for high torque . . . refined by Bristol engineers for greater accuracy and ruggedness.

Advances in electrical measurement naturally come from Bristol, experienced for nearly 60 years in building hundreds of thousands of recording voltmeters and ammeters for almost every application . . . the finest, most dependable products.

Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

Find out all about these superior instruments by writing for Bulletin E1111 to THE BRISTOL COMPANY, (116) Bristol Road, Waterbury 20, Conn.



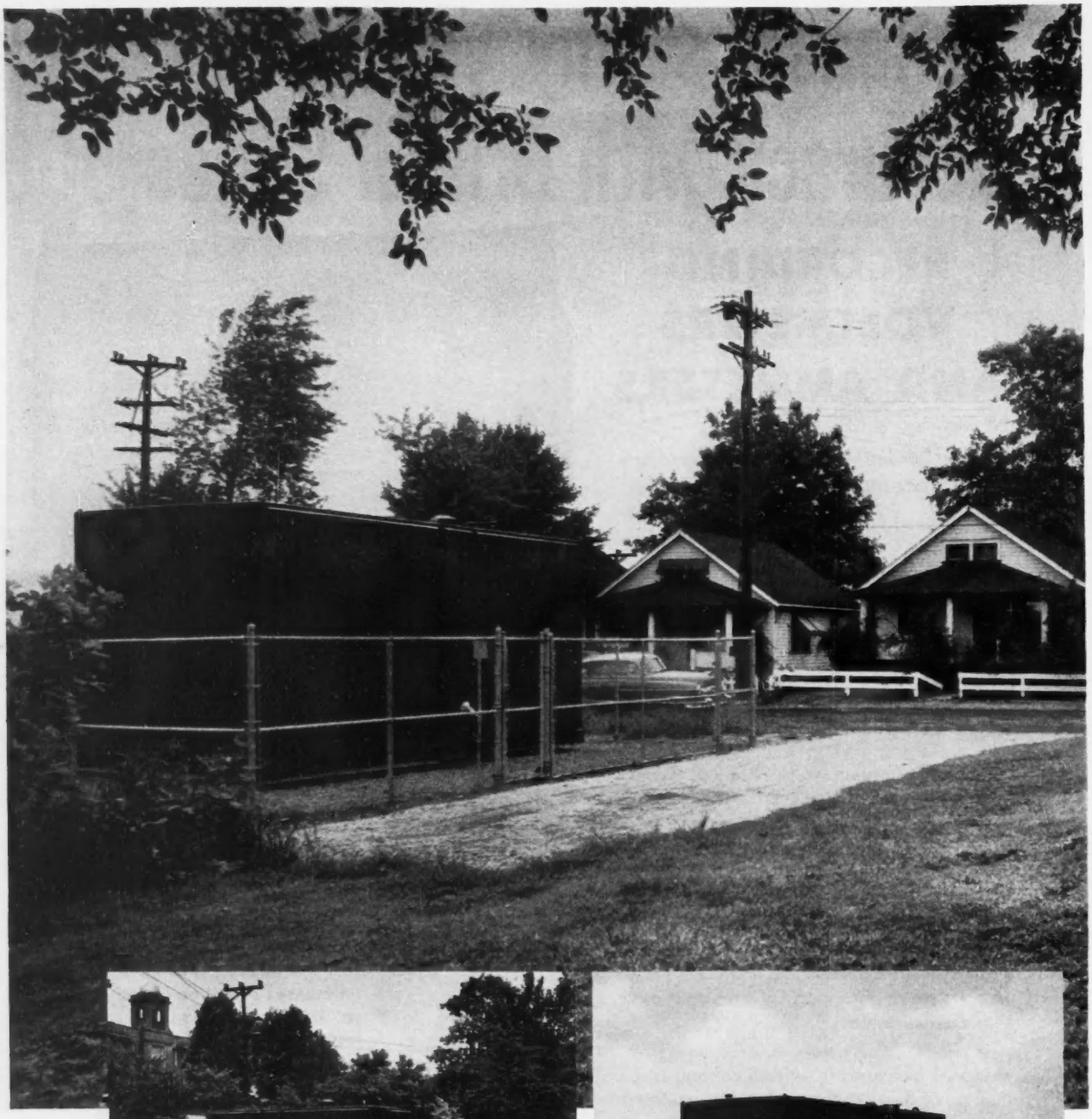
Permanent mounting offered in three models: interchangeable surface and flush, surface-panel and flush panel. Note the pleasing, well-balanced appearance. Also, *portable instruments* are offered in two models: for setting on floor or table; for mounting on walls or poles and general service.

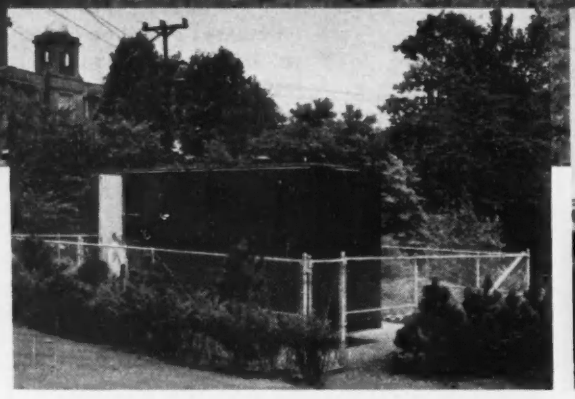
New ball-bearing suspension, loaded by a coil spring, prevents damage even under severe mechanical shock. Stainless steel bearings and shaft are almost tool hard and are corrosion-resistant.

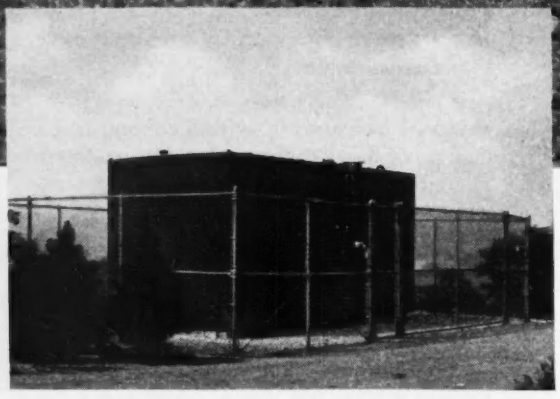
BRISTOL

The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS







This "CSP®" Power Transformer, rated 2000 kva, HV 22.9 kv, LV 4360 volts, was designed by Westinghouse in cooperation with Duquesne Light Co. of Pittsburgh, to meet their specific requirements. Installed in North Bessemer, Pa., it is neat in appearance, contains complete high and low-voltage switchgear, metering and protective equipment.

"Contoured-design" units, like this installation in McKeesport, Pa., may help solve substation problems for you, too. Complete enclosure enhances the safety factor, simplifies landscaping problems. Ask your Westinghouse representative for further information, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

"One of the best neighbors I've ever had . . . !"

"The Westinghouse substation next to my house at 1222 Twenty-fifth Street Extension, Beaver Falls, Pennsylvania, is one of the best neighbors I've ever had," says Mrs. Roy W. Thompson, shown at the side entrance to her home.

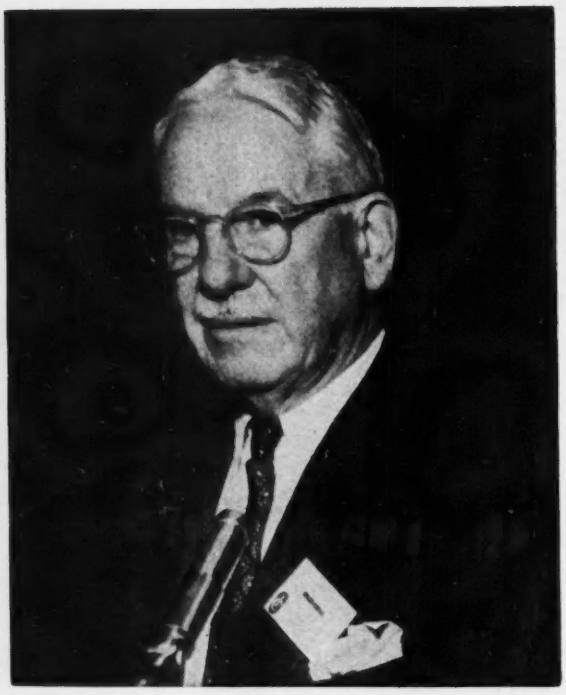
"Recently I acquired a new neighbor, the one shown here. Westinghouse Electric Corporation and Duquesne Light Company, who worked together to develop this unit, call it a contoured-design, single-circuit substation. I'm not sure what all that means, but I can see why they call it contoured. It's completely enclosed in what looks like a large cabinet—not at all like some substations I've seen . . . the Duquesne Light people have explained to me that the enclosure not only makes the installation attractive, but completely safe, and that even without the fence there would be no danger. And, after Duquesne Light shrubs around the fence, we'll hardly know it's there because it certainly is quiet. Even my TV reception is better—they say that's because of better voltage regulation. Maybe so, anyway, I like my new neighbor."

J-70710

YOU CAN BE SURE . . . IF IT'S

Westinghouse

GE's Cordiner scores "gloomy pessimists" predicting recession



Westinghouse's Robertson hails power industry's integrity

EMI Leaders Address RPI Parley

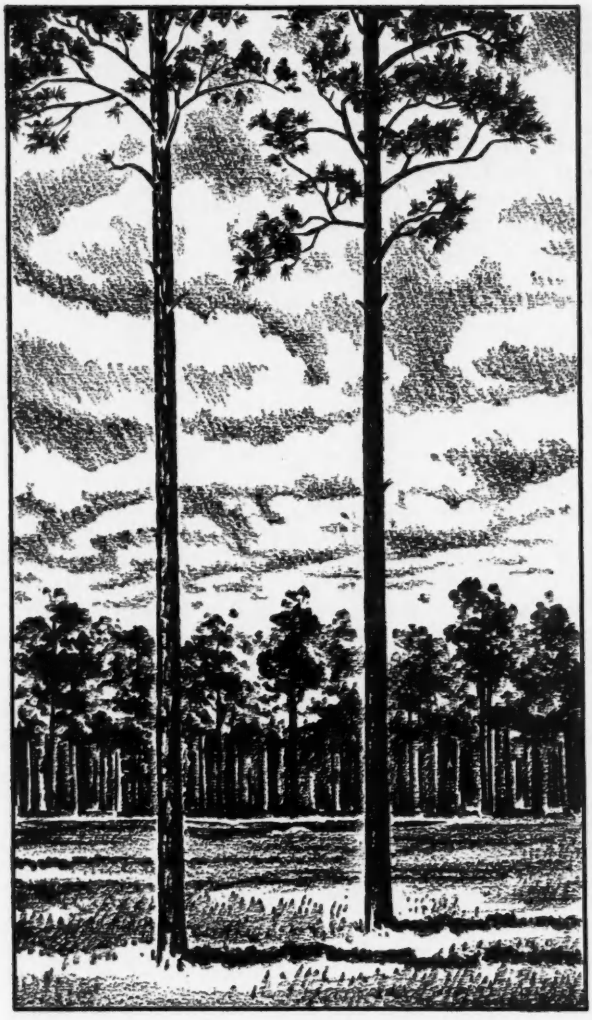
Don Mitchell cites power boost as factor of mass-producing industries

The role of the electrical manufacturing industry in the modern economy and defense mobilization was discussed before 1,000 industrialists and educators who attended the third Industrial Council held recently at Rensselaer Polytechnic Institute, Troy, N. Y.

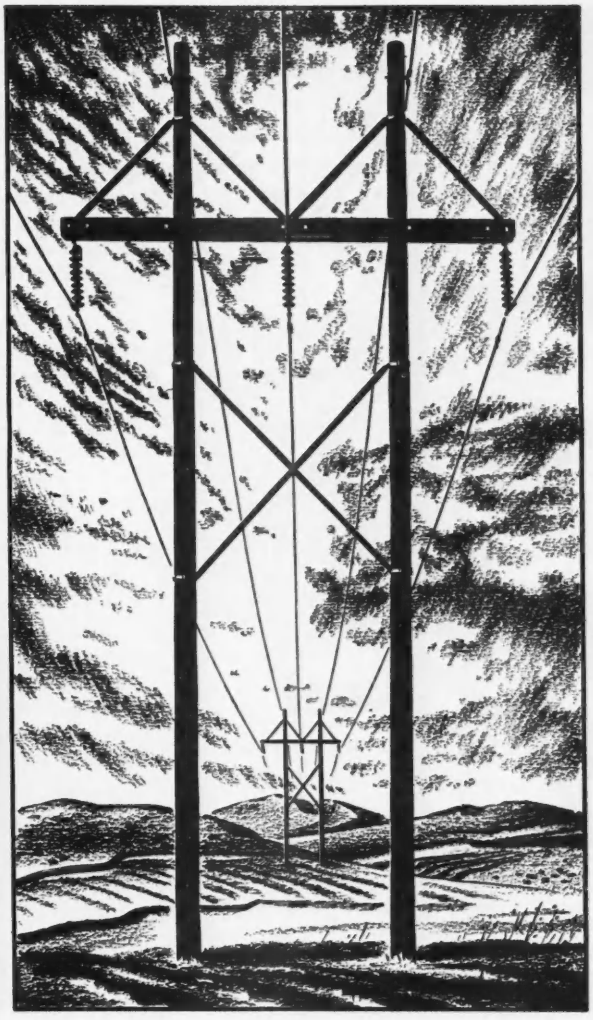
The meeting, sponsored by companies in the industry and organized by RPI, eonsisted of 18 forums at which 150 top executives and 600 college and high school social studies teachers analyzed the electrical manufacturing industry's major contributions.

Major speakers at the Council sessions included Ralph J. Cordiner, president, General Electric Co; Don G. Mitchell, chairman of the board of Sylvania Electric Products, Inc; Andrew W. Robertson, finance chairman, Westinghouse Electric Corp; and Dr Allen B. DuMont, president of Allen B. DuMont Laboratories, Inc.

Recession Fears Unjustified . . . In scoring "gloomy pessimists" predicting recession, Cordiner held entirely unjustified the fears that the growth in American industry in recent years has been so largely stimulated by defense production that the rate of such growth will abate. He asserted that the annual totals in goods and services produced in the U. S. from the beginning of the electrical manufacturing industry 75 years ago down to today, makes clearly apparent the "fallacy of the mature economy."



These trees required over 100 years to grow to usable size. It takes a great deal of labor and expense to transform them from living trees to poles. The growth years and the labor expenditures represented constitute a very considerable investment deserving the best in preservation and protection.



These poles are the valuable result of many growth years, man-hours and heavy expense required to cut, trim, frame, treat, deliver and erect them as poles in the line. Are you justified in gambling with unproved wood preservatives when protecting such an investment in man-hours, manufacturing and erection expense?

Why take chances on unproved wood preservatives... when you can get full protection with

BARRETT COAL-TAR CREOSOTE

Only Coal-Tar Creosote gives you this long-lasting protection!

- *Time-tested and proved by over 100 years' use*
- *Defies rot, insects and marine borers*
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- *Weather-proved in every climate*
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•Reg.U.S.Pat.Off.

You won't be taking chances with your valuable poles when you specify BARRETT — time-tested leader in the field of Coal-Tar Wood Preservatives.

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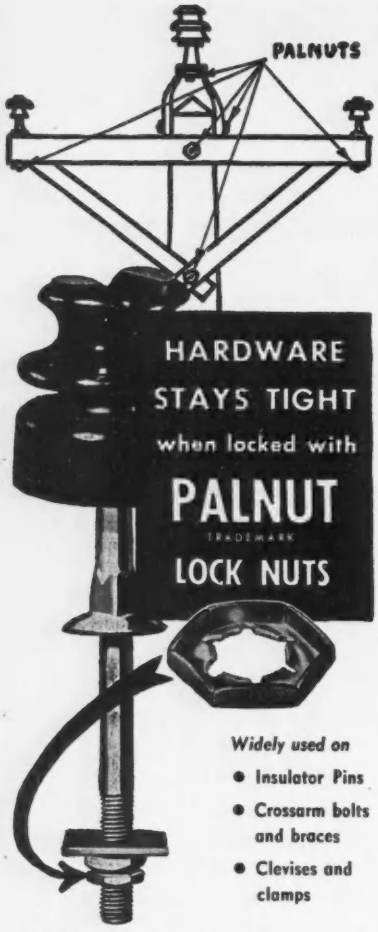

- Eliminate checking and re-tightening
- Eliminate radio interference due to loose hardware

Every bolt-and-nut assembly locked with PALNUT Lock Nuts stays tight, despite weather, wind, stress and vibration. PALNUTS, tightened on top of the regular nuts, prevent loosening and falling off. Very low in cost—easily, speedily applied—require little space—may be used on new or existing assemblies. Hot dip galvanized, silicon bronze and other materials and finishes. Stocked by all leading pole line hardware manufacturers.

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PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

Cordiner declared that the private electric utility industry alone is spending $20 billion in the ten post-war years and may well have to double its volume of service and facilities in the next ten years. The electrical manufacturing industry as a whole is expected to account for 6% of the entire national production in 1963 as compared with 4.1% in 1952, and only 1.75% in 1925.

Industry must be prepared to build, install, and service as much electrical equipment in the next ten years as it has in the entire preceding 75 years of its history, he declared.

In commenting on research and development, Cordiner foresaw turbines of a million kilowatt capacity and transmission up to 1 million v.

Aided Mass Production . . . Sylvania's Mitchell cited the ten-fold increase in power generation between 1920 and 1952 as a major cause of the mass-producing industries.

"Today's figures make 1925 dwindle into comparative obscurity," Mitchell said. He quoted the following figures: wired homes, 42 million; television sets, 21 million; refrigerators, 38 million; washers, 32 million; irons, 38 million.

Mitchell noted that employment in the electrical industry has increased from 90,000 to 900,000 since 1910. Salaries and wages, then about $50 million today exceed $3 billion. Value added by manufacture has leaped from $120 million to more than $6 billion.

Robertson said the use of electricity in the United States has doubled every ten years since 1910 and this goal will again be attained by 1960.

He said the amazing growth of the power industry is in great part based on its honesty and reliability.

"The thing which made the past 50 years outstanding," Robertson said, "is the fact that everywhere we turn—at home, at work, at play—we have almost unlimited power, force or energy to do our bidding. A large percentage of this energy is provided by electric power."

Fifty million television sets will be in operation within five years, DuMont declared. He added, however, that cost will make the swing to color television slow.

$500 Color TV Receivers . . . Dr Du Mont predicted that within a few years color television receivers, with screen sizes equivalent to the present 21 in. black and white sets, will be sold in the neighborhood of $500. That, he commented, is still a high price for mass usage and purchase. Over the next ten to 20 years he expects color television eventually to be fully integrated with present black and white broadcasting.

The DuMont executive said early color television receivers are expected to have screens equivalent to the old 12 in. black and white receivers and probably cost about $1,000.

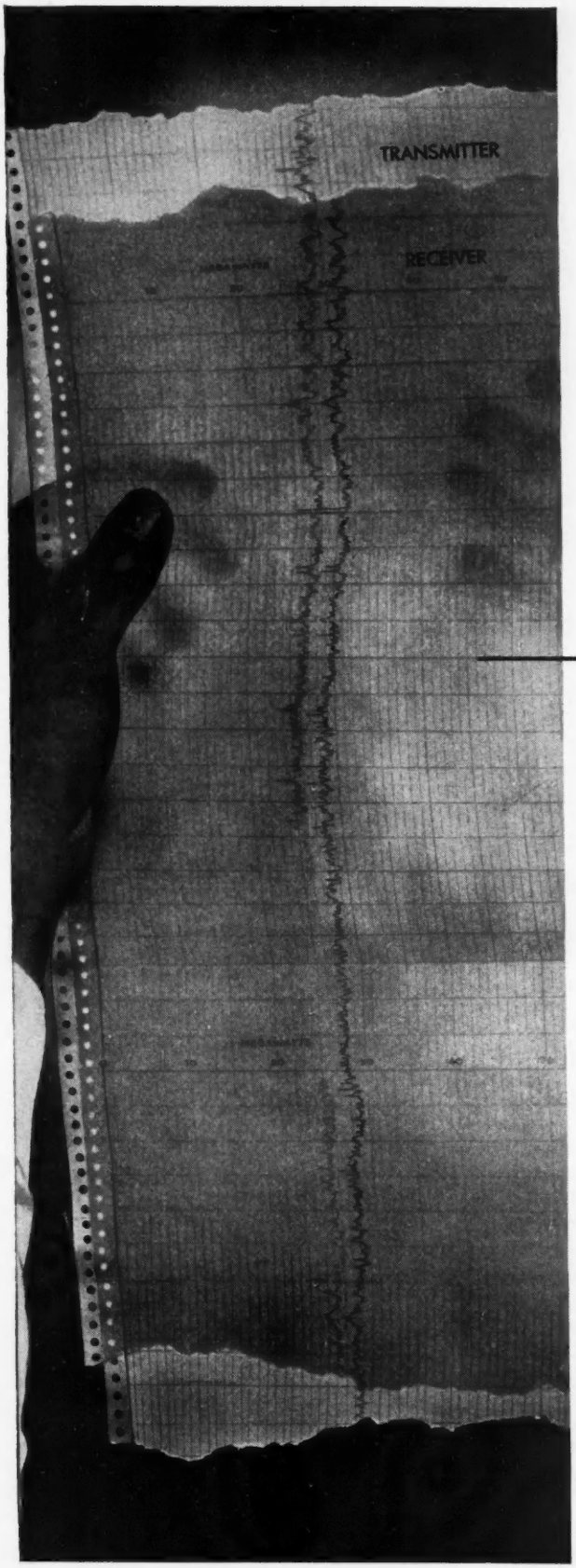
MEETINGS CALENDAR

***Edison Electric Institute**
EEI Industrial Relations Committee Joint Meeting with New England Regional Group, Statler Hotel, Boston, Nov. 19; Prime Movers Committee, Astor Hotel, New York, Nov. 30-Dec. 1; Street Lighting Committee, Dayton, Ohio, Dec. 1-2; EEI-AGA General Accounting Committee, Jung Hotel, New Orleans, Nov. 30-Dec. 1; Commercial Lighting Committee, Detroit, Mich., Dec. 2-3; EEI-AGA Customer Accounting Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, Dec. 3-4; Financing and Investor Relations Committee, EEI Headquarters, New York, Dec. 9; Commercial Cooking and Water Heating Committee, Tutwiler Hotel, Birmingham, Ala., Dec. 10-11; Industrial Power and Heating Section, Sheraton Hotel, St. Louis, Dec. 10-11;

MANUFACTURERS' EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Bowser	9	Sept.	$415,431	$585,957	$....	$....
Colt's Manufacturing	40 wks	Oct.	585,837	449,096	1.46	1.12(a)
E. I. du Pont de Nemours	3	Sept.	58,070,645	54,045,988	1.21(b)	1.14(b)
E. I. du Pont de Nemours	9	Sept.	172,829,089	155,754,111	3.62(b)	3.26(b)
Minnesota Mining & Manufacturing	3	Sept.	4,652,715	3,955,617	.55	.48
Minnesota Mining & Manufacturing	9	Sept.	13,708,826	11,442,337	1.63	1.39
Revere Copper & Brass	9	Sept.	7,910,664	4,787,682	6.14	3.72
Rome Cable	3	Sept.	409,000	496,000	.82(c)	1.02(c)
Rome Cable	6	Sept.	933,000	1,058,000	1.87(c)	2.17(c)
Sangamo Electric	9	Sept.	1,633,077	1,427,745	2.33	2.04
U. S. Rubber	9	Sept.	21,488,326	18,912,141	3.32	2.83

Notes—(a) Based on number of shares now outstanding; (b) Based on average number of shares outstanding during the period; (c) On shares outstanding at close of respective periods.



TAKE A "data picture"

OF YOUR SYSTEM LOAD with "shadow-accurate" Speedomax Telemeters

● The two load curves on the left were recorded on a pair of Speedomax® Telemeters—one transmitting, the other receiving. As you can see, the curves line up. As a matter of fact, when you hold these charts up to a strong light, you can't tell them apart.

By using these "shadow-accurate" Speedomax Telemeters, you can feed generating and tie-line data from remote parts of your system into a centrally located Dispatcher's Office, giving your Load Dispatcher a clear picture of operating conditions throughout the system.

Such telemetering accuracy is essential to minimum operating costs. Just as a pilot needs unerring instruments for pin-point navigation, so your Dispatcher needs accurate load data to effectively utilize incremental loading schedules and cost-cutting control techniques.

If you're thinking about tomorrow's operating costs, you will want to look to L&N today. Speedomax Telemeters are an integral part of L&N Load-Frequency Control—a control which is backed by application engineers who have made more than 300 installations during the past quarter century.

For a complete picture of what L&N can do for your system, write to 4938 Stenton Avenue, Philadelphia 44, Pa.

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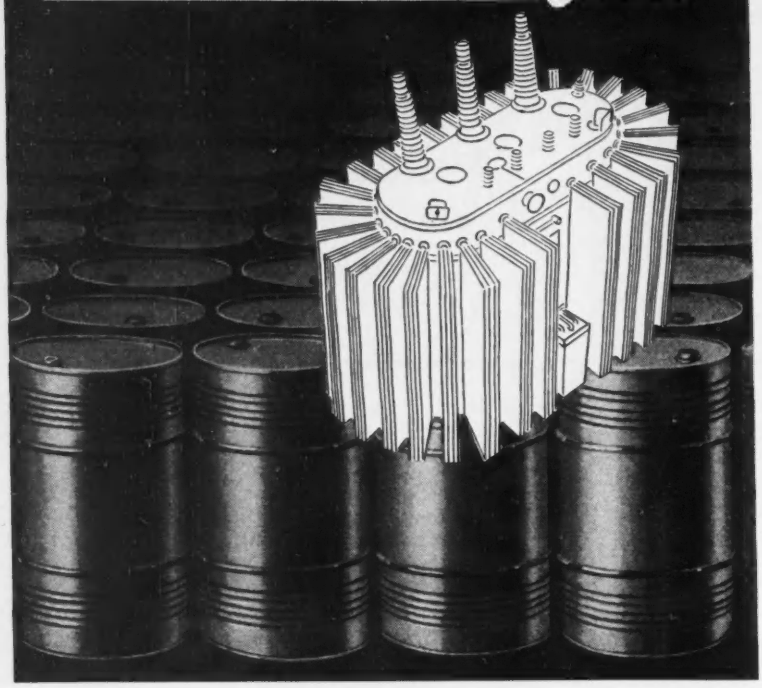
instruments *automatic controls • furnaces*

Jrl. Ad. ND4-56-461(12)

Transformer oil, treated with DBPC *lasts 14 times longer!*



• Accelerated oxidation tests have proved that new transformer oil treated with 0.3% of DBPC inhibitor (di-tert-butyl-para-cresol) will last *14 times longer* than untreated oil. Since today's high-load transformers require a sludge-free insulating oil to operate efficiently, the extra-long life offered by this Koppers anti-oxidant is highly important from a technical as well as an economical standpoint. DBPC assures more dependable transformer performance by increasing the resistance of the oil to oxidation, thereby keeping sludge formation to a minimum.

Reclaimed oil will last longer, too, when treated with DBPC. Although badly deteriorated and heavily sludged, used oil can be restored by treatment with fuller's earth and DBPC so that it will actually outlast brand new uninhibited oil.

DBPC is available in an oil solution called "Impruvol 20." In either solution or solid form, this Koppers inhibitor is also used successfully in switch gear. Write today for additional information.

KOPPERS

Koppers Chemicals

KOPPERS COMPANY, INC.

Chemical Division, Pittsburgh 19, Pennsylvania

EEI-AGA Accounting Employer Relations, Hotel Cleveland, Cleveland, Ohio, Dec. 14; Commercial Electrical Space Heating and Air Conditioning Committee, Canton, Ohio, Dec. 17-18; Industrial Relations Committee, EEI Headquarters, New York, Dec. 17, 1953; Accident Prevention Committee, Hotel Statler, Boston, Jan. 18-19; Industrial Relations Committee Joint Meeting with Personnel Administration Section, Southeastern Electric Exchange and Southwestern Personnel Group, Hotel Roosevelt, New Orleans, La., Jan. 21-22; EEI-AGA Taxation Accounting Committees, Arlington Hotel, Hot Springs, Ark., Jan. 27-29; Transmission and Distribution Committee, Hotel Cleveland, Cleveland, Ohio, Feb. 9-10; Electrical Equipment Committee, Sheraton Cadillac Hotel, Detroit, Mich., Feb. 15-16; Industrial Relations Committee, EEI Headquarters, New York, March 18; Sales Meeting, Edgewater Beach Hotel, Chicago, April 5-8; EEI-AGA Accounting Conference, Hotel Statler, Boston, April 12-14; Industrial Relations Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, April 15; Annual Meeting, Atlantic City, N. J., June 1-3, 1954.

Pacific Coast Electrical Association
Annual Hawaiian Conference, Honolulu, T. H., Nov. 19-20.

New Jersey Utilities Association
Annual Meeting, Seaview Country Club, Absecon, N. J., Nov. 19-20.

Southeastern Electric Exchange
General Sales Conference, Atlantic Biltmore Hotel, Atlanta, Ga., Nov. 19-21; 21st Annual Meeting, Boca Raton Hotel, Boca Raton, Fla., March 22-24, 1954.

Public Utilities Advertising Association
Region 8 Meeting Amarillo, Tex., Nov. 23-24; Region Two, Annual Meeting, Skytop, Pa., Dec. 10-11; Region 5 Meeting, Atlanta, Ga., Feb. 11-12; Region 1 Meeting, Montreal, Que., Feb. 25-26.

American Society of Mechanical Engineers
Annual Meeting, Statler Hotel, New York, Nov. 29-Dec. 4, 1953; Semi-Annual Meeting, William Penn Hotel, Pittsburgh, June 20-24, 1954.

Eastern Joint Computer Conference-Exhibition
Sponsored by Institute of Radio Engineers, Association for Computing Machinery, and American Institute of Electrical Engineers, Statler Hotel, Washington, D. C., Dec. 8-10.

***National Rural Electric Cooperative Association**
Annual Convention, Dinner Key Auditorium, Miami, Fla., Jan. 11-14.

American Institute of Electrical Engineers
Winter General Meeting, Statler Hotel, New York City, Jan. 18-22, 1954; Northeastern District Meeting, Schenectady, N. Y., May 5-7, 1954; Summer General and Pacific General Meeting, Hotel Biltmore, Los Angeles, June 21-25, 1954.

***National Industrial Electric Heating Conference**
Industrial Electrification Council, Netherlands Plaza Hotel, Cincinnati, Ohio, Jan. 18-22.

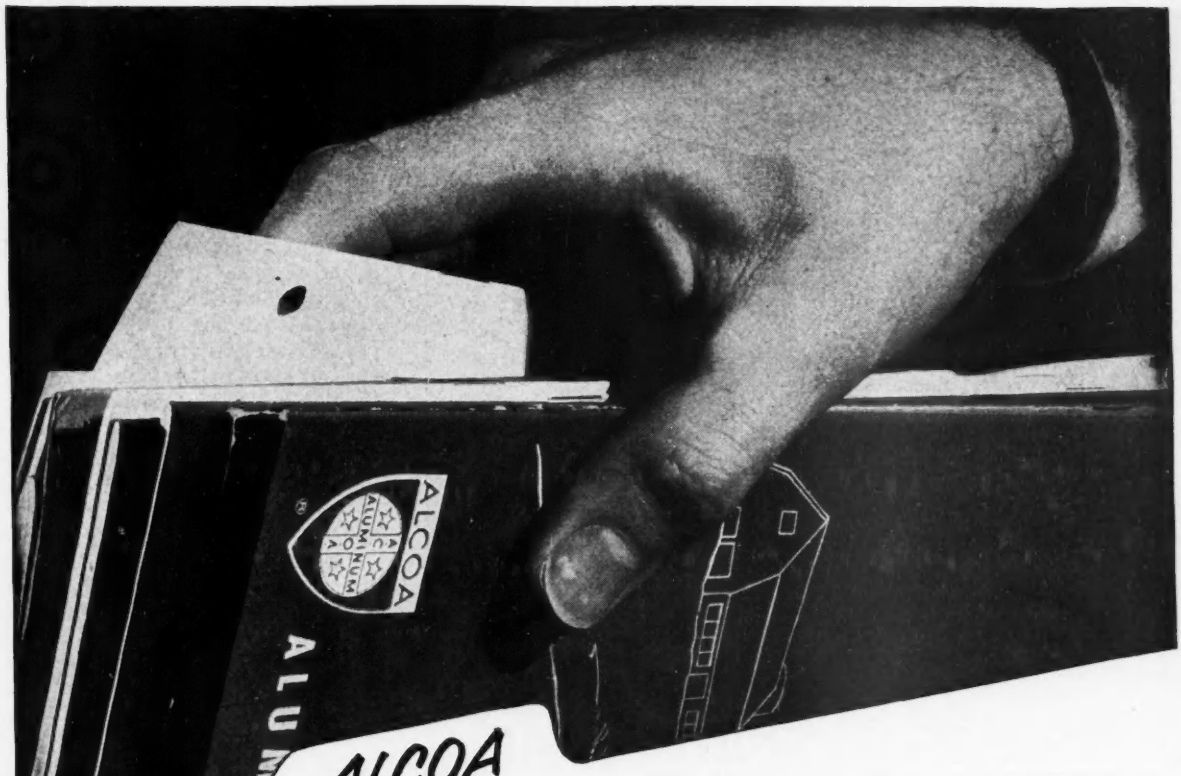
***Missouri Valley Electric Association**
Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 4-5, 1954; Engineering Conference, President Hotel, Kansas City, Mo., April 7-9, 1954.

Electrical Equipment Representatives Association
Winter, Annual Meeting, Biltmore Hotel, Los Angeles, Feb. 8-11, 1954.

***Southern Safety Conference-Exposition**
Kentucky Hotel, Louisville, Ky., March 7-9, 1954.

***National Electrical Manufacturers Association**
Spring Meeting, Edgewater Beach Hotel, Chicago, Mar. 8-11, 1954.

***Addition this week.**

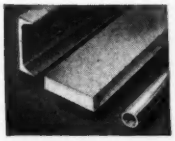


Responsibility...
and a fist full of books!

Alcoa currently publishes hundreds of booklets and pamphlets—over twenty-five dealing with aluminum electrical conductors alone. Their subjects range from products to procedures, their titles from *Aluminum Bus Conductors* to *Voltage-Drop Charts for Insulated Aluminum Cable.* You'll see them on the desks of men in all phases of the electrical power industry.

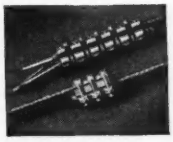
At first blush, publishing seems a far cry from the aluminum conductor business. For many companies, it is; but not for Alcoa. This technical literature is the printed product of Alcoa's sense of responsibility toward customers. A responsibility to help them make the best use of the best product. A responsibility we assumed when we introduced aluminum electrical conductor over 55 years ago. Aluminum Company of America, 2100-L Alcoa Building, Pittsburgh 19, Pennsylvania.

Alcoa Aluminum Bus Conductors are available in rectangular bars, solid round bars, channels and tubular shapes.



Alcoa Aluminum Electrical Conductors include Aluminum Cable Steel Reinforced, solid and stranded aluminum wire, bare and covered.

Alcoa manufactures aluminum accessories correctly designed for use with aluminum conductors.



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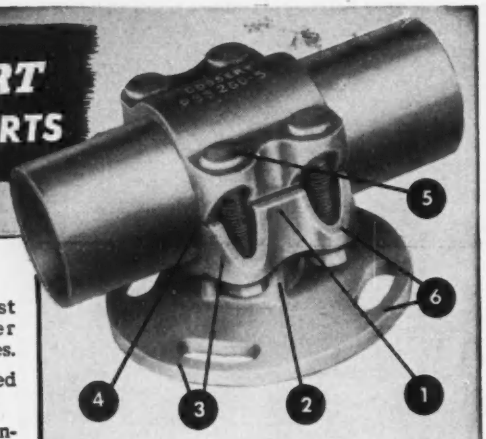
Alcoa brings the world to your armchair with "SEE IT NOW" featuring Edward R. Murrow. Tuesday evenings on most CBS-TV stations.

DOSSERT BUS SUPPORTS



Type PSS

1. Designed to resist severe cantilever and impact stresses.
2. Heavy-duty, ribbed throat underbody.
3. One-piece, rigid construction.
4. Slip-fit and tight-fit by reversing cap.
5. Silicon bronze high-strength bolts...oval neck connector or hex head type.
6. High strength bronze alloy . . . non-magnetic . . . corrosion-resistant.

Write for Catalog 53-4. Also available for aluminum conductors. For aluminum conductors write for Catalog A54-4.

A rugged Bus Support Clamp which permits rigid or slip-fit clamping on tubular bus conductors. Unique features make this clamp an outstanding support for trouble-free, enduring service.

Also available on specification with an 8-hole slotted base.

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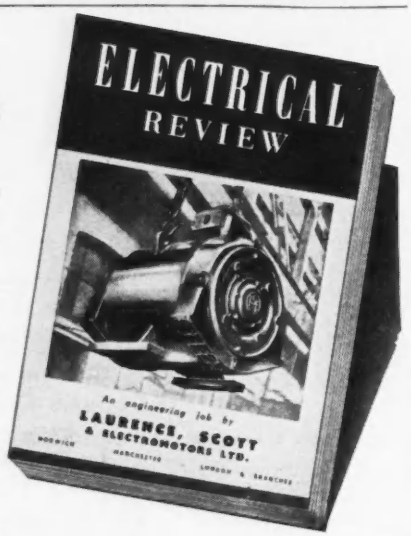
It'll cost you NOTHING to see for yourself...



Last year, Britain exported $700,000,000 worth of electrical plant and equipment to the United States and elsewhere. Generators, motors, switchgear, meters . . . all playing their vital part in industry, and in defence production. Want to know more about these products? Then send, right away, for a free copy of ELECTRICAL REVIEW, the journal which tells what goods are available and where to get them. It's Britain's most widely-read electrical paper.

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E.W

EEI Equipment Meeting

(*Continued from page* 111)

vacuum. But L. F. Hunt of the same company predicted that a suitable method would be found.

Interconnection Benefits . . . Evaluation of fixed charges may show far greater economies from power pool operations, said W. E. Caven, Atlantic City Electric Co. He presented a case where buying power from the Pennsylvania-New Jersey interconnection permitted a two-year delay in completing a 75-Mw generating plant addition. Savings to ACE are $3 million, he said, and the entire interconnection benefits eventually from the addition of a larger more efficient generating unit.

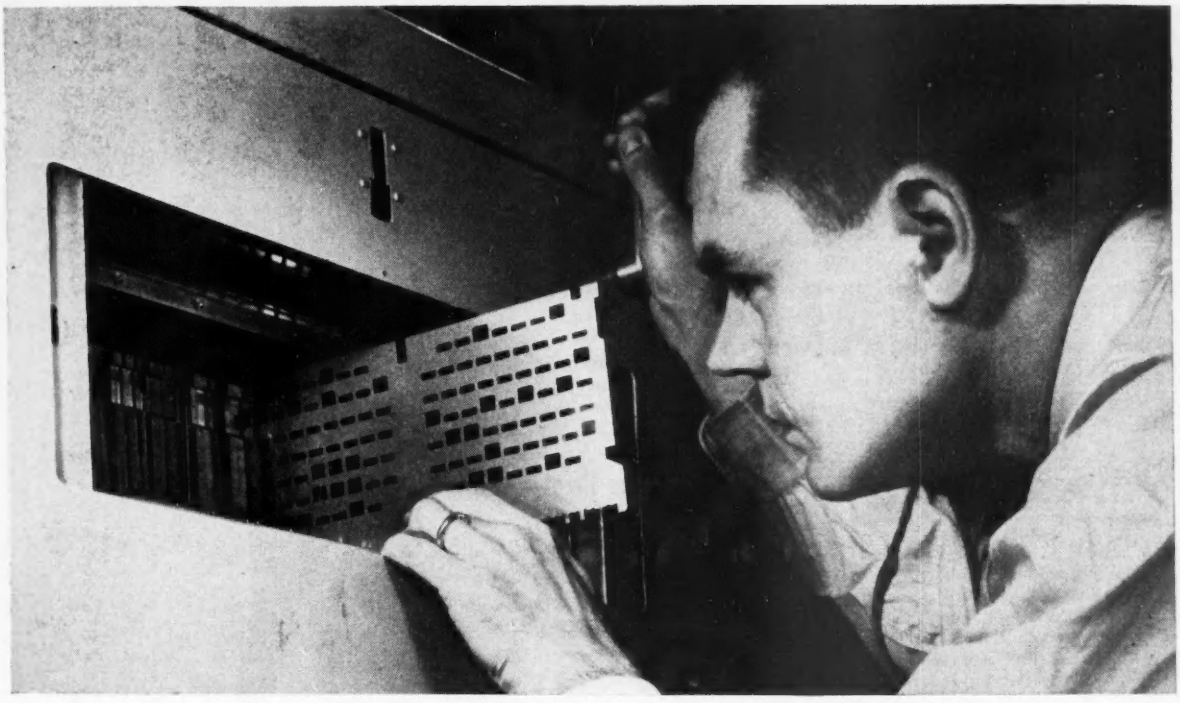
Load growth at the average rate of 13.9% per year since 1916 poses major problems for Houston Lighting & Power Co, reported L. K. Del' Homme. Whether the future will follow the pre-war trend of 9.9% or the post-war trend of 16.2% is the key question, he said.

With interconnection capacity limited to less than the present largest unit, Houston must aim at self-sufficiency, he said. The program requires completion of four new units totaling 550 Mw before the 1956 peak. The new Sam Bertron station site is adequate for 1,000 Mw, he said, and another similar site is now contemplated.

Higher Voltages . . . Transmission needs, Del'Homme continued, have upped the voltage to 132 kv. And a loop will gradually be completed around the city at that voltage. Concurrently 33 kv has gone out of the picture, he said, by rebuilding to 66 kv. Lines of both voltages are now being built with 800 Mcm all-aluminum conductors. This conductor was selected, he said, when it was found that existing structures designed for 397.5 Mcm ACSR could support it.

All distribution growth is taken at 12 kv, Del'Homme said. And distribution substations are standardized on a maximum of four 7,500/10,000-kva transformers. Planning now provides the 12-kv system on an area basis in advance of needs, he said.

Discussion brought the suggestion from R. E. Pierce and Chase Hutchinson, Ebasco Services, Inc, that 12-kv feeders need not be limited to 5,000 kva load. Instead, they said, even 10,-



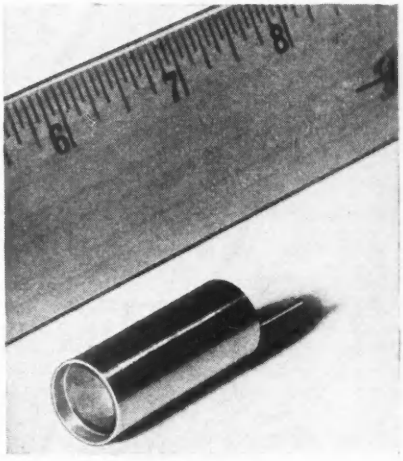
Checking perforated metal card in Bell's new "card file" which uses Phototransistors to help route Long Distance telephone calls along the best routes. If the first voice-way is in use, a "detour" is swiftly found. The equipment is known in telephony as a "card translator."

CARDS FOR CONVERSATION

To find out how to route Long Distance calls a dial system needs lots of information—fast. To provide it Bell Laboratories engineers developed a new kind of card file—one that dial systems can read.

Punched holes on metal cards tell how calls should be handled. When a call arrives the dial system "asks" the "card file" how to proceed to a particular area. Instantly the appropriate instruction card is displaced so that its pattern of holes is projected by light beams on a bank of Phototransistors. In a flash the Phototransistors signal switches to set up the best connection. Cards are quickly changed when new instructions are needed.

The "card file" will have its widest use in speeding Long Distance calls that are now dialed by a telephone operator and may one day be dialed by you personally. It is another example of how Bell Telephone Laboratories helps telephony to grow, as costs are kept down.



New Phototransistor unit. Light entering the cylinder is focused by the lens on a piece of germanium that responds by generating current. Like the Transistor, the Phototransistor was invented in Bell Telephone Laboratories.

BELL TELEPHONE LABORATORIES

IMPROVING TELEPHONE SERVICE FOR AMERICA PROVIDES CAREERS FOR CREATIVE MEN IN SCIENTIFIC AND TECHNICAL FIELDS

HANDY ANDY SAYS,

DUXSEAL®

plugs 'em easier-and better!

Duxseal is a nonhardening adhesive plastic compound made with an asbestos base. Stays plastic, will not slump, melt or run under ordinary temperatures. Clings to duct walls and cables but flexes with expansion and contraction. Unaffected by water and gases—does not react with rubber, metals or painted surfaces. For full details write Johns-Manville Box 60, New York City 16; in Canada, 199 Bay St., Toronto 1, Ontario.

Duxseal is a general utility sealing and caulking compound for duct openings, potheads, bushings and terminal boxes. Use like putty as it comes from the package

Johns-Manville SEALING COMPOUNDS

000 kva would be feasible.

Somewhat similar presentation of the effect of load growth on New Orleans Public Service brought further support for high-voltage distribution. C. L. Rhodes said that original protection system of spill gaps and high speed reclosing has given way to shield wires on their 13.8-kv system. Performance record now is almost as good as underground cable, he said.

Rhodes also described a single-pole 115-kv line through city streets. No cases of damage by traffic to the 85-ft poles has occurred, he said, and the performance is excellent.

NW Power Pool Members to Meet in Seattle Dec. 7

Gov Len Jordan, Idaho, announced Nov. 3 that all members of the Northwest Power Pool—both East and West groups—would be called to a meeting at Seattle on Dec. 7. The meeting will be to set in motion plans to keep power supply expansion ahead of demand. The date was fixed by governors of Idaho, Washington, Oregon, and Montana at the Western Governors Conference in Albuquerque.

Jordan said all power suppliers in area would be invited, federal and non-federal.

Earlier, discussing the need for a meeting, Jordan said "the federal government has tossed us the ball; it looks like it's up to us to run with it."

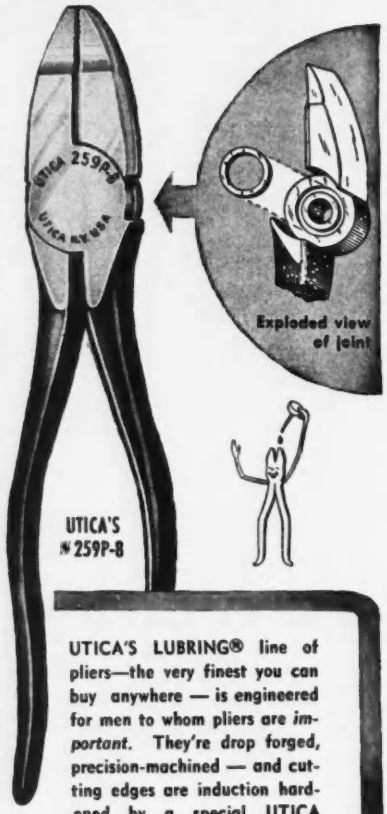
He said he referred to government's announced intention of seeking greater participation by state and local groups in power and related developments. Said Jordan, "the trouble is, up to now, nobody's been doing any planning for needed expansion." Then he added, "we don't want to get caught up in any valley development authority."

Klamath River Project Being Studied by USBR

Reclamation Bureau's California Projects Office in Sacramento has announced that a "reconnaissance study" of the Upper Klamath Basin in Oregon has turned up a possible plan for development of the power potential of the Klamath River between Keno and Copco Lake.

The plan would lift river waters 200 ft for conveyance via a multi-

PLIERS THAT OIL THEMSELVES!



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UTICA'S LUBRING® line of pliers—the very finest you can buy anywhere — is engineered for men to whom pliers are *important*. They're drop forged, precision-machined — and cutting edges are induction hardened by a special UTICA process.

Each UTICA LUBRING® pliers has a ring of porous iron floating in the joint. This ring serves as a tiny reservoir for oil and releases it to the joint *as it's needed*.

In these days of limited replacements, why not make sure you get the long life and quality that go with UTICA®?

It Pays to Use Quality Tools!
And the world's best tools are made in U.S.A.

UTICA® DROP FORGE AND TOOL CORPORATION UTICA 4, NEW YORK

In Canada: ADLAM TOOL & SUPPLY CO., LTD.

You expect the best value from G-E fluorescent lamps

Silicone coat on new G-E Rapid Start lamps helps them start quicker

Moisture in the air can make a fluorescent lamp slow to start. The wet film that condenses on the lamp is a good enough conductor to detour some of the electricity needed for proper starting.

General Electric has tailored a "raincoat" that stops this. It's made of silicone and breaks up the wet film into tiny droplets, leaving dry areas that interrupt the electrical contact. Less current is stolen. Starting is quicker, surer.

We call the coating Dri-Film*. The photo above shows the difference it makes. Moisture breaks up into droplets on the Dri-Film* lamp, forms a smooth coating on the ordinary lamp.

You get Dri-Film* on G-E Rapid Start lamps. It's invisible, won't rub off, helps assure you all the light you pay for. Many leading manufacturers have designed lighting fixtures to use Rapid Start lamps and their special Rapid Start ballasts. You *expect* the best value from G-E fluorescent lamps. Here's another reason you can.

For more information, write General Electric, Department 166-WE-11, Nela Park, Cleveland 12, Ohio.

*Reg. U. S. Pat. Off.

You can put your confidence in—

GENERAL ELECTRIC

SAVED! 152 Man Hrs.! REDUCED . . . 190 Labor Hours to 38 with a Wilton

Patent pending Motor-Powered BRUSH SAW

Tree-man W. S. Rowland cleared 459,800 sq. ft. of 15-ft. California willows from a power-company right-of-way *in 38 hours*, with a WILTON Motor-Powered Brush Saw! He writes of his men's experience with a Wilton, clearing 100% cover (up to 5" diameter) over 2 miles long, 30 ft. wide:

"Cutting 90% of the growth . . . was done by 2 operators with wide experience clearing brush by hand . . . the saw was in operation for 38 hours . . . approximately 20% of their average time for cutting by hand. Performance of the saw demonstrates: 1. Excellent balance and light weight reduce operator fatigue to minimum. 2. Same belt with which job was started is still on saw, drives blade at maximum power. 3. Maximum facility in cutting through heavy brush . . . from pivoted arm and light weight. 4. Exceptional motor performance. 5. Maximum convenience due to position of starter cord and motor throttle."

Note how ruggedly, conveniently the Wilton Motor-Powered Brush Saw is designed and built. Further data sent promptly on request.

Automatic recoil starter
Blade set at 10° for cutting
Simple centrifugal clutch
3500-4000 r.p.m.
Push-button stop control
Weight under 30 lbs.

Shoulder strap distributes weight
2" tubular aluminum shaft with 1/16" thick wall
Entire saw fits in car trunk
Bearings sealed in oil
Aluminum thigh shield for perfect balance, easier guiding

$295.00 FOB, Milford, N. H.

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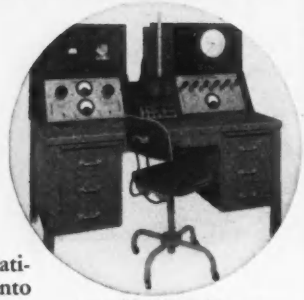
Automatically Controlled with STATES Automatic CONTROL TABLE for THERMAL DEMAND WATTAGE LOAD



Form "FDM" Table with Automatic Load Holder

• A constant wattload maintained automatically. The automatic Load Holder built into the States Control table means, that you get complete accuracy in Thermal Demand testing because the average wattage throughout the test run is maintained automatically. It eliminates the need of supervision during test run.

This equipment is designed to operate at and to hold the load at power factors of 100% and 50% and at normal voltage of 120 volts. Average wattload is held within 0.1%.

This graph indicates supply voltage for a two day run.

This graph shows resulting watts due to influence of automatic load holding.

THE STATES COMPANY
3 New Park Avenue, Hartford, Conn.
I am interested!
Please send latest information on Form "FDM" Thermal Demand Table.
Name ..... Title .....
Firm .....
City ..... Zone .... State .....

You'll do well to investigate the States' new versatile Form "FDM" Thermal Demand Table now.

THE STATES COMPANY

purpose system through Butte Valley, then tunnel them back to the Klamath River canyon where 1,400 ft of head would be developed by a Shovel Creek power plant.

After the report was issued, bureau officials emphasized any power plan is "very tentative." The bureau emphasized the reclamation agency's comprehensive report on the findings of the Upper Klamath Basin investigation will not be completed at a field office level until mid-1954.

"If further detailed studies confirm this plan of power development as the most desirable," the bureau said, "the cost of irrigation water and of removing drainage and flood waters through such a multipurpose system would be considerably less than through a single purpose system designed for irrigation and drainage only.

"Even aside from its advantages to irrigation in Butte Valley, this plan for power gives promise of being better than any so far proposed for development of a hydro potential between Keno and Copco Lake. Its apparent advantages are that it would develop the entire available head at an early date and do so at a cost comparable to the most economical units that could be developed under any other plan. All other power plans so far proposed or studied could develop only a portion of the total available head at this time, development of the remainder being so expensive that it might become feasible only in the distant future."

Quake Suggested as Factor in B. C. Plant Disaster

Possibility that a minor earthquake might have been one cause of August slides which destroyed the British Columbia Power Commission's Whatshan power plant on Lower Arrow Lake (EW, Sept. 21, p 117) has been suggested to a royal commission currently conducting an investigation of the disaster.

Dr Henry Cecil Gunning, dean of the faculty of applied science at the University of British Columbia, told the investigating group at Vancouver he had been unable to find evidence of any geological phenomenon which would have caused cracking of the 2-mile power tunnel through the mountain, letting water into the hill-

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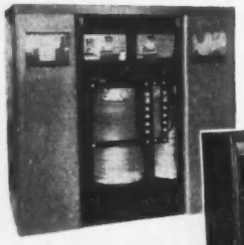

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side and possibly contributing to the mud slides.

He suggested a check of all earthquakes recorded since building of the tunnel.

He said the slides could have been caused by natural conditions without additional water leakage from the tunnel, but that such seepage could have contributed to the catastrophe and such leakage would have increased the danger.

There was no evidence of a serious fault in the rock, he stated.

He said that to a geologist conditions around the Lower Arrow Lake are "merely temporary" and that "slides, washouts and movements are the expectable thing in B. C."

Any trained geologist examining the site, he reported, must "inevitably have appreciated the possibility of slides there," which could be dealt with by remedial action, including a drainage system and removal of about 250,000 cu ft of soil from the upper slopes.

He said the movement of earth which nearly engulfed the switching yard 14 months before should definitely have put those responsible for the plant on their guard.

Power Commission Chief Engineer A. W. Lash told the inquiry that a movement of less than 1/16th-in. in the rock could have cracked the concrete lining of the tunnel and caused the seepage which it is suggested brought about the slides.

He said a fault which had been opened up during driving of the tunnel had probably altered the mountain's drainage which would send water into the fault, washing out clay and soil and causing the granite blocks to settle.

'Act of God' Explanation for Wire Mishap Upheld

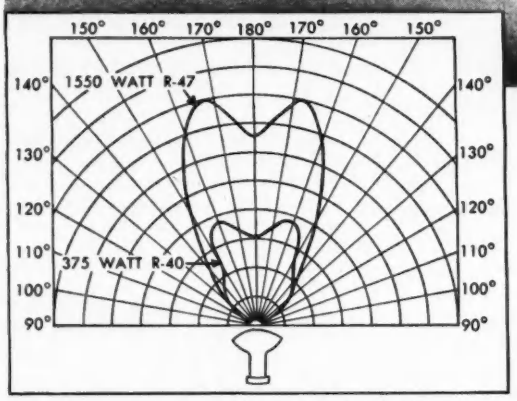
Contention that an "act of God" caused a live wire to fall on a man proved a successful defense for British Columbia Power Commission in a civil law suit at Pouce Coupe in B. C.

Supreme Court Justice J. M. Coady dismissed the suit of Clarence M. Eckert, Dawson Creek carpenter, for $986 medical expenses and unstated damages for injuries received when he came in contact with a live wire which fell from a power line July 2, 1951.

Eckert lost the thumb and two

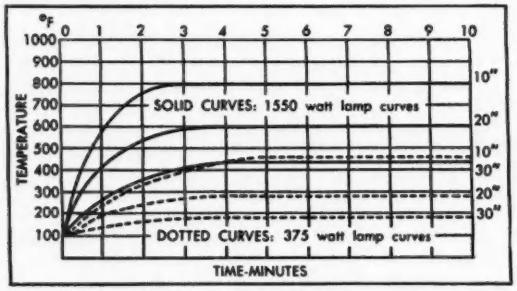
Sylvania's Powerful New INFRARED LAMP

Opens New Fields in Heat Processing!



Comparison of Angular Radiation Distribution

The two curves show a comparison of energy concentration of Sylvania's 1550-watt lamp against a 375-watt lamp. Readings were taken on a 2-foot radius. Note greater radiation of 1550-watt lamp over larger area.



Comparison of Temperature Levels

The above graph shows a comparison between temperature levels reached with Sylvania 1550-watt lamps and 375-watt lamps on .035 inch thick cold rolled steel placed 10, 20, and 30 inches from a 3 x 3 lamp bank.

Delivers 3 times more radiation per square inch than conventional Infrared Lamps

PROVIDING a wattage density much higher than ever before available for infrared lamps (36 watts per square inch) Sylvania's powerful new lamp now opens up an entirely new field of applications plus new economies in infrared commercial drying, baking, and heating.

This improved lamp is equipped with 2 separate filaments and may be operated at three different wattages (650, 900, and 1550) thus permitting close control of infrared output.

Rugged and durable

Made of Vycor glass, the bulb is highly resistant to thermal shock and is unaffected by spattering liquids during operation.

Designed with a built-in gold reflector, which maintains 90 to 95% of its initial reflectivity, the lamp projects useful heat over an angle of approximately 120°.

For further technical information concerning the amazing performance and adaptability of this latest Sylvania achievement, write to: Sylvania Electric Products Inc., Dept. 3L-2711, 1740 Broadway, New York 19, N. Y.

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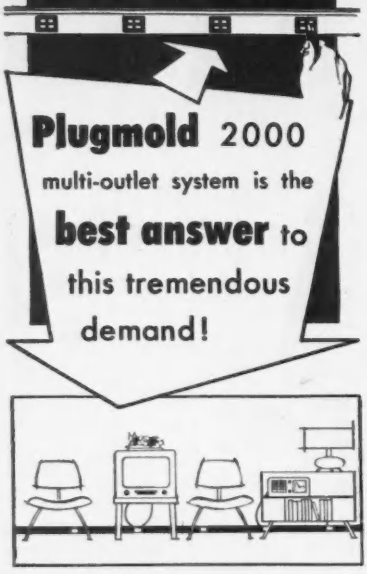

Plugmold 2000 multi-outlet system is the **best answer** to this tremendous demand!

Home-buyers — and present owners — are insisting on more outlets! Factories everywhere want more power outlets right at work benches. Offices, hospitals, schools need more outlets.

This nationwide demand is a multi-billion dollar market—even when cut down to size in your own town, it is tremendous! And it's there . . . right now.

Plugmold 2000 is the fastest, easiest, cheapest way you can provide multiple convenience outlets. If you aren't working with Plugmold now, write today for full information. Better yet—order the 20-foot Introductory Package from your distributor.

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fingers of his right hand and suffered 33 burns on his body as a result of the accident, which he alleged was due to improper construction of the power line or failure to keep it in proper repair.

The power commission contended that the accident was the result of an "act of God," since it occurred during a violent thunder and lightning storm.

World Power Production for 1952 Sets Record

World production of electric power set a record in 1952, according to figures in the November "Monthly Bulletin of Statistics" issued by the United Nations. Output last year was 1,139 million Mwhr, the report showed. This, it was noted, was two and one half times the power production for 1937.

World capacity (excluding plants in China and North Korea and power facilities in industrial plants in certain countries for which data are lacking) was listed in the Bulletin as 270 million kw, an increase of 130 million kw since 1937.

Nuclear Power Station Planned in Netherlands

AMSTERDAM (McGraw-Hill World News)—FOM, the Dutch institution for Fundamental Research of Matter of Utrecht, and KEMA, the electricity research center of Arnhem, have decided to establish an experimental atomic energy power station near Nymegen.

The station is planned for completion within five to eight years, at which time it will generate enough electricity for commercial purposes to permit operation on a commercial basis. It's expected that cost price will be not much higher than that of electricity from coal. Initial capacity will be 100,000 kw.

McNary Power Produced

Corps of Engineers began generating hydropower at McNary Dam Nov. 4 on test runs of the first 78,000 kw generator, nearly a full month ahead of schedule, as the reservoir reached a semi-permanent level of 335 ft. First two McNary generators are expected to start producing power for the Northwest Grid in December.

Only PLUGMOLD 2000 gives you SWITCHED and HOT OUTLETS in the SAME Receptacle!

WIREMOLD's exclusive SNAPICOIL eliminates multiple connections between short lengths – receptacles are pre-wired in 50 foot coils.

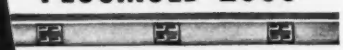
The Snapicoil 3-wire duplex receptacles of the new Plugmold 2000 multi-outlet system have one side *switched* and one side "*hot*"—this exclusive Plugmold feature means *extra* convenience in homes, stores, offices . . . everywhere.

The same size Plugmold 2000 raceway also accepts Snapicoil 2-wire duplex all "hot" or NEMA 2-wire grounded receptacles. Only *one size raceway* is needed on the job!

Plugmold 2000 is easier, faster and cheaper to install!

Write today for the new, free Plugmold 2000 book!

PLUGMOLD 2000



WIREMOLD'S *New* multi-outlet system

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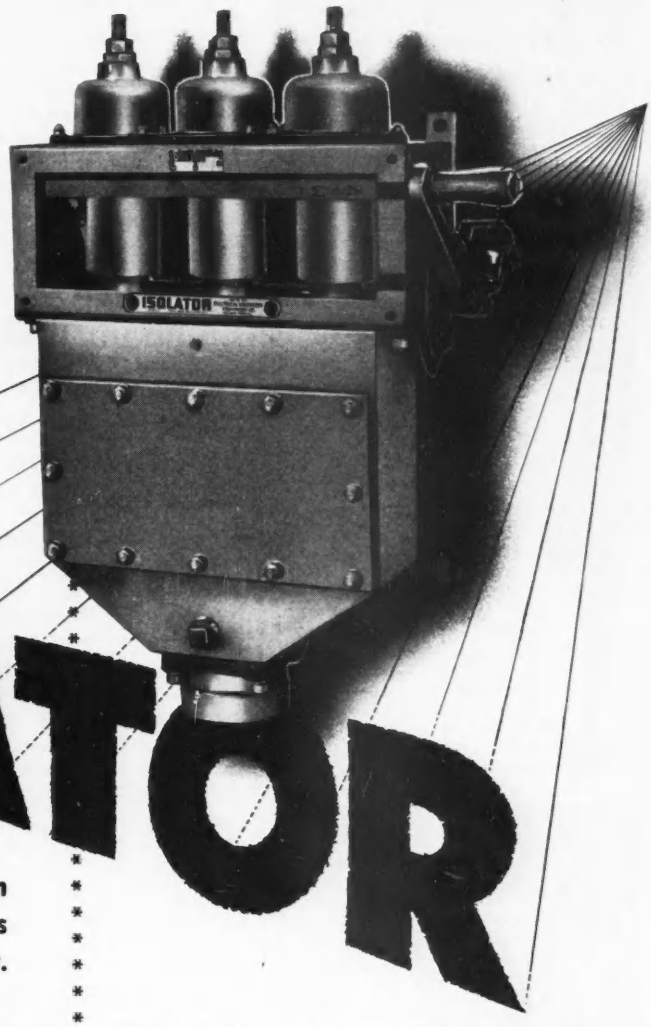
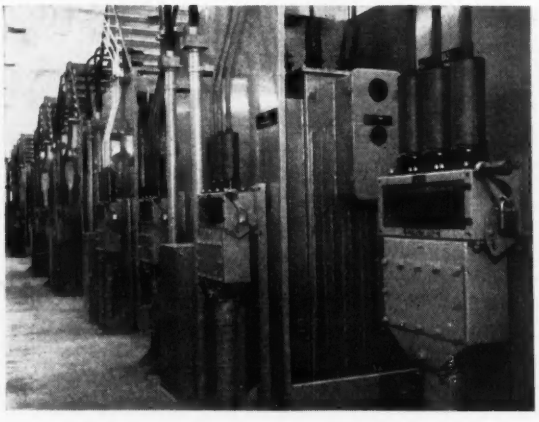
you can do it BETTER with an . . .

ISOLATOR



This is more than just a slogan. In hundreds of electric power installations it has proved itself as more efficient.



Pictured is an installation of CABLE ISOLATORS, one of "Three E" most efficient devices employing ISOLATOR design principles.

Here the Cleveland Electric Illuminating had to provide terminating and disconnecting means for twelve 4600 volt, three conductor cables at one of their strategically located substations. They did it the modern way by using CABLE ISOLATORS.

They —
- Protected live parts
- Saved space
- Saved material by doing the job with one compact double duty device.

"They did it better with an ISOLATOR"

Send for our bulletin 140 and see how you can use the ISOLATOR to good advantage.

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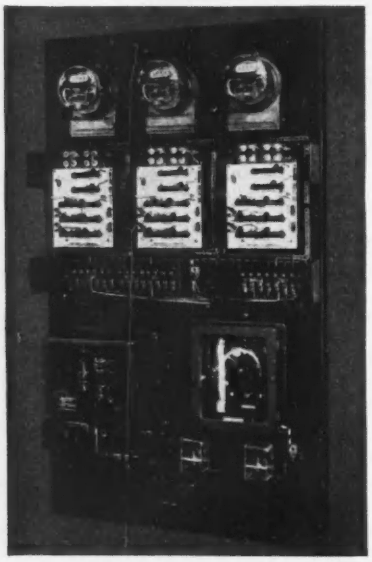

HERE ARE TESCO Transformer-Loss Compensators on a two-element 6.6 KV 18,750 KVA metering installation with three transformer banks. Metering is compensated to the 66 KV dual service supply. Compensator and panel covers removed.

EASTERN

SPECIALTY COMPANY

PHILADELPHIA 40, PA.

Georgia P&L

(*Continued from page* 138)

"The above comparison of power costs raised the question whether or not Georgia P&L could obtain its power requirements from another source at lower cost. The PSC has instituted an investigation of this question."

Company Created...

. . . will be known as Northern Illinois Gas Co. It will take over gas properties of Commonwealth Edison

Commonwealth Edison Co, Chicago, has announced that it proposes to create a separate corporation to own and operate the gas properties of its Public Service Co Division. Application to the Illinois Commerce Commission for the necessary authority will be made in the near future.

Under the program, the Public Service Division, which supplies both electricity and gas in a large suburban and northern Illinois area outside Chicago, would continue its electric operations as at present, while the new gas company would be incorporated as the Northern Illinois Gas Co.

A Forward Looking Move . . . Willis Gale, Edison chairman, said separation of the Public Service gas and electric operations began many years ago and this further step is a forward looking move for both the company and the public.

"Technical and operating problems of the electric and gas business are entirely different," he said. "Such a segregation would aid in the solution of the problems confronting each of these growing utilities and would recognize the stature attained by the gas business which has doubled its revenues since 1945.

"The new company would be the second largest gas utility company in Illinois both in terms of gross revenues and in number of customers. Further, separation of the gas and electric properties is a natural development to improve the effectiveness of operations and to create a more competitive situation in the best interests of customers and employees. This is also

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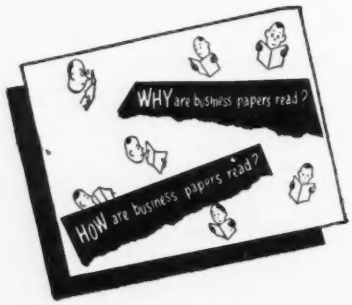

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in keeping with recent trends in the utility industry.

Bonds to Be Sold . . . "If the separation is carried out, a substantial block, perhaps $60 million, of mortgage bonds constituting a lien on the gas properties would be sold to public investors by Edison as the next step in financing its $1.1 billion postwar construction program. Upon transfer of the properties, the new gas company would assume the sole obligation on the bonds, which would represent about 50% of the net book value of the gas properties.

"All of the stock of the new gas company would be owned by Commonwealth Edison Co. Management and personnel of the new company would be unchanged from that of the present Public Service gas operations.

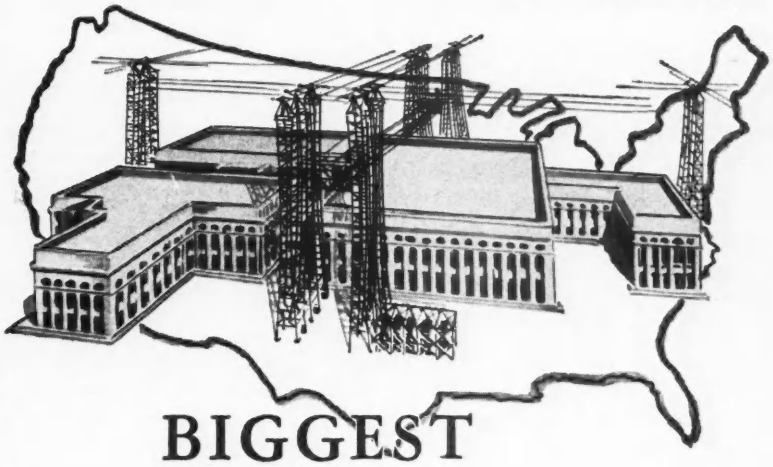
"Ultimately, it is expected that some program will be worked out to effect a separation of the stock ownership of the new gas company. One plan under consideration is to distribute over a period of years the stock of the new gas company to Edison's common stockholders."

FINANCIAL BRIEFS

Federal Power Commission has authorized Beverly Gas & Electric Co, Gloucester Electric Co, and Salem Electric Lighting Co to consolidate into Essex County Electric Co. FPC has also approved the consolidation of Suburban Gas & Electric Co into Malden Electric Co. The name of the former company will be changed to the Suburban Electric Co.

Carolina Power & Light Co has sold to Tidewater Gas Co for $550,000 the gas properties it acquired when it merged with Tidewater Power Co.

Dividend Increases—Houston Lighting & Power Co will pay Dec. 10 a quarterly common stock dividend of 30¢ a share as compared with 25¢ a share in the previous quarters . . . Minnesota Power & Light Co will pay Dec. 1 a quarterly common stock dividend of 27½¢ a share and an extra of 10¢ on the new common outstanding after a two-for-one stock split in October. This brings total declarations this year to $1.20 on shares outstanding after the split, compared with $1.10 in 1952.



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All guaranteed accurate length — accurate weight as marked.

BOOK REVIEWS

Metals

Fatigue of Metals. **By R. Cazaud. Published by Philosophical Library, Inc. New York 16, N. Y. 334 pages, illustrated. Price $12.50.**

A British expert has translated this authoritative French work. First the distinction between fatigue failure and failure under conventional stress-test is drawn and the anomalies attributed to a multiplicity of uncontrollable (often unidentifiable) variants of service use and exposure. Mechanism of failure is reviewed in theory, the type of fatigue-testing machines and then many data on fatigue limits. The last third is dedicated to discussion of the possibilities of improving the fatigue strength of machine components. This section is probably the most pertinent for those in the power field who have been ruffled by unpredictable and unexpected apparatus failures due to fatigue.

Electronics

Introduction to Electron Microscopy. **By C. E. Hall. Published by McGraw-Hill Book Co. 451 pages, illustrated. Price $9.00.**

Many more electron microscopes have been produced than experts to use them intelligently. On this assertion the author justifies the book and the MIT graduate course for microbiologists and virus researchers. Theory of electron beam control precedes the fundamental description of the electron microscope. This is followed by a discussion of the numerous commercial forms, how to interpret the irregularities and how to manipulate the apparatus and the specimens for best results. Throughout the book theory is subordinated to the aim to teach and train competent electron-microscopists.

Turbine Analysis

Gas Turbine Analysis and Practice. **By Burgess H. Jennings and Willard L. Rogers. Published by McGraw-Hill Book Co, Inc, New York 36. 491 pages, illustrated. Price $8.50.**

Gas turbines have enjoyed spectacular development for aircraft propulsion. And this book draws heavily upon that field.

But the basic data and principles are not changed by application to locomotives and utility plants. Treatment of gas compression is supplemented by extensive tables of air properties. A wealth of data are included about the properties of materials peculiar to gas turbines. And extensive bibliographical references guide procurement of additional specialized information.

Primarily written as a text for engineering students, this book should also be useful to utility engineers faced with the need to study gas turbines for power generation.

Labor Relations

Successful Labor Relations for Small Business. **By James Menzies Black and J. George Piccoli. Published by the McGraw-Hill Book Co, New York 36, 425 pages. Price $6.00.**

This book shows the principals and techniques you can use to secure better contracts and to avoid or clear up labor disturbances. It gives you pointers on how to set up the important written policy you need on labor relations procedure, and exactly what to do when faced with such matters as the representation election, the strike, and the unfair labor practice charge. You are given the basic rules of company strategy to follow when faced with an organizational drive. How to act from the moment a union representative approaches you to the day of the election.

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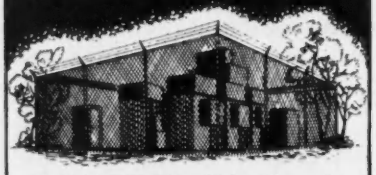

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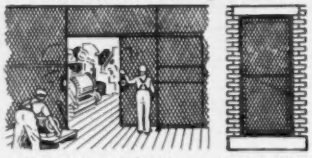
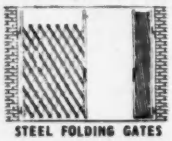


WIRE MESH PARTITIONS WINDOW GUARDS



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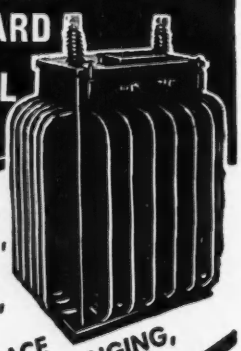

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● **TEMPERATURE LOGGER:** A new electronic console indicator is described in bulletin just announced under the title "Log 200 Temperatures In Minutes." Design of the console affords an unobstructed view of the whole control room panel during heat-balance checks, comparison checks of panel-mounted instruments, and measurements of independent temperatures. Other design features are slide-out indicator housing, removable switching panels, legend strip holders, terminal board arrangements, and adjustable wiring duct. Ask for Folder ND46-33A(2) from Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

● **L-M CATALOG, NEW SECTIONS:** The following new and revised bulletins for inclusion in the general L-M catalog have been announced. DL3 on guying materials; DL4 on grounding equipment; LA2 on Type E lightning arrester; LA4 on Type DL lightning arrester; FC5A on fuse links (new EEI-NEMA ratings); CR2 on oil switches. If the above have not been received for Line Material's general catalog, write to Line Material Co, Advertising Dept, Milwaukee 1, Wisconsin. A master check list for the entire catalog will also be included.

● **HIGH VOLTAGE HANDLING TOOLS:** Catalog Section 823 on Handling Tools has been announced as covering a complete line designed specifically for high-voltage switches, fuses, and cutouts. Improved safety and faster operation are featured. Each tool attaches to a standard universal pole of the type used for high voltage devices. Universal poles from 4 ft to 20 ft are also listed. Ask for Sect. 823 from S & C Electric Co, 4435 Ravenswood Ave, Chicago 40, Illinois.

● **ELECTRONIC DIGITAL COMPUTOR SERVICE:** High speed computation services on the Model 1 Burroughs Laboratory Computer are now available to business, manufacturers, trade and scientific organizations. Computation services already performed have included turbo-engine design, performance calculations, pipe stresses, optical ray tracing, antenna calculations, and statistical correlations. The computor features magnetic drum memory systems, punched paper tape input and output facilities, including photoelectric read-in; and extensive checking circuits to avoid error. For information on the computor and/or the services, write to Electronic Instruments Division, Burroughs Research, 511 N. Broad St, Philadelphia 23, Pa.

● **ELECTROPLATING POWER UNITS:** Metallic rectifier dc power supplies are covered by a 15-page catalog announced by General Electric Co. Application to similar processes such as electrolytic pickling, electro-polishing, electro-forming, electrolytic cleaning and anodizing is also described. Complete ratings and dimensions for both manual and automatically controlled systems are listed. Write to General Electric Co, Schenectady 5, N. Y., and ask for GEC-970.

● **ELECTRONIC ANALOG COMPUTING DEVICES:** A new revised general catalog covering latest developments, new components, and prices of the George A. Philbrick Researches, Inc analog computing assemblage has been announced. A true table-top computor is said to be achieved by the new Operational Manifold, Model HK, which utilizes the versatile K2-W operational amplifier. Application to mathematics, engineering, and simulation is covered, together with additional customer services. Write to George A. Philbrick Researches, Inc, 230 Congress St, Boston 10, Mass.

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3— 333KVA W-H	6600-2300
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3	100	G. E.	7200—240/480M
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2400/4160 Y—240/480
3	250	G. E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228 DRY TYPE

INDUCT. REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
3— 48 KVA West. 200 A. 2400 V. 1 ph.
8— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

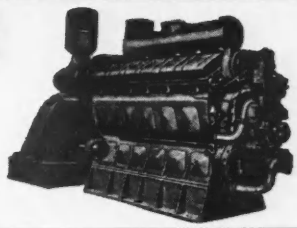
CIRCUIT BREAKERS

4— 800 A. 132 KV West.G-222A-2500 MVA
2— 400 A. 37 KV G. E. FHKO-136-350 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

BREW, WOLTMAN & CO., INC.
52 Church Street, New York 7, New York

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1136	Fairbanks Morse	38D	1600	720	300	General Motors	8-268A	450	1200
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Ingersoll-Rand	8-4	225	600
500	General Motors	8-278A	750	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	100	Worthington	BB-5	150	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	8-8	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Qu.	KW	Make	Desc.
1—	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter.
1—	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B.P., 480-3-60
1—	200	Whse.	Non-Cond. 125/150# ISP 5/10# B.P., 240/480 Y-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1—	12500	Whse.	25/60	13200 x 13200
1—	3750	G.E.	25/60	4150/2400 x 2400/4150
1—	3125	G.E.	25/60	4150/2400 x 2400/4150
2—	2500	G.E.	25/62½	2300 x 4160
1—	1250	G.E.	25/58.3	4400 x 2300
1—	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS

3 ph, 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1—	3000 3U	G.E.	514	600	4000/13200
2—	2000	G.E.	450	250	2400
2—	2000	G.E.	514	600	6600/13200
1—	2000	G.E.	500	666 25 cy.	11000
2—	1750	G.E.	514	250	2400
1—	1500	C.W.	514	115	4000/13800
1—	1500	G.E.	720	600	13200
1—	1000	G.E.	900	260	4100/6900
2—	1000	Whse.	900	600	2300/4150
1—	750	Whse.	900	275	2300/4150
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300

TRANSFORMERS—60 Cycle

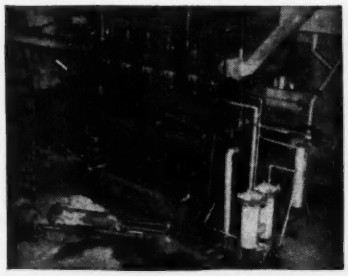
KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—3500	G.E.	WCT	3	13800 x 2300/440
1—2500	Whse.	OISC	3	26400/13200 x 480
3—2000	G.E.	HVDDJ	1	66000 x 13800
3—1250	G.E.	HVDDJ		6600/550
3—1000	G.E.	HVDDJ	1	2200/480

REBUILT BELYEA MOTORS

BELYEA COMPANY, INC.
OFFICE & SHOP
51 Howell St. Jersey City 6, N. J.

185 KW DIESEL GENERATING UNIT

480 V. 3 ph. 60 cycle



Intermediate Speed—Like New

Engine: Ingersoll Rand Type S, 273 BHP 720 rpm, air starting, 5 cyl, 1946 model

Accessories: Woodward Governor, oil & fuel filters, water pumps, fuel & water tanks heat exchangers, starting equip.

Generator: Elliott 231 KVA, 185 KW, 480 v. 3 ph, 60 cycle, .8 pf, with 5 Kw exitor.

Also includes panel board, piping, extra parts and tools.

Write for complete specifications & price

MACHINERY CENTER, INC.
Formerly: Roger Pierce Equipment Sales Co.
808 Newhouse Bldg. Salt Lake City, Utah

TURBO GENERATOR
Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525° F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION
Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

WORLD'S LARGEST INVENTORY
FREE CATALOG
MOTORS—GENERATORS—TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.
ELECTRIC EQUIPMENT CO.
P. O. BOX 51, ROCHESTER 1, N.Y.

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GUARANTEED MOTORS
M.G. SETS • GENERATORS
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Units of Every Size and Description
WE'LL SELL, BUY OR TRADE
PHONE CANAL 6-2900
CHICAGO *Electric Co.*
1324 W. CERMAK ROAD
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J. L. HEMPHILL & CO.
ELECTRICAL ENGINEERS & EQUIPMENT
1606 53rd ST., NORTH BERGEN, N. J. N.Y.C. Tel.: LOngacre 5-3227 N. J. Tel.: UNion 3-2600

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V. 2300V. Pyranol
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
3— 200 KVA G.E., 1 Ph., 13200V. 440V.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM. 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM. 220V. 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V. 3/60.

MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V. 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM, 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM, 4000V. Syn.
1— 150 KW G.E., 125/250V, 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM. 2300V. Syn.

SLIP RING MOTORS

2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW. 450 RPM, 550V.
1— 250 H.P., West., CW. 600 RPM, 440V.
1— 200 H.P., West., CW, 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3PH, 60 Cy.
Large Stock of A.C. and D.C. Equipment

Utility saves with "Scotch" Plastic Tape

"Scotch" 33 Plastic Electrical Tape saves three ways at the power plant of a large utility in New England.

First, it *saves application time* since only one tape is needed for mechanical and electrical protection. And "Scotch" 33 conforms smoothly to odd-shaped surfaces, sticks tight with only slight finger pressure.

Second, it *saves space* since it's only 7 mils thick. Yet "Scotch" No. 33 has a dielectric strength of 10,000 volts per layer. Gives neat, compact results.

Third, it *saves money* since a little goes a long way. And "Scotch" 33 lasts longer, too.

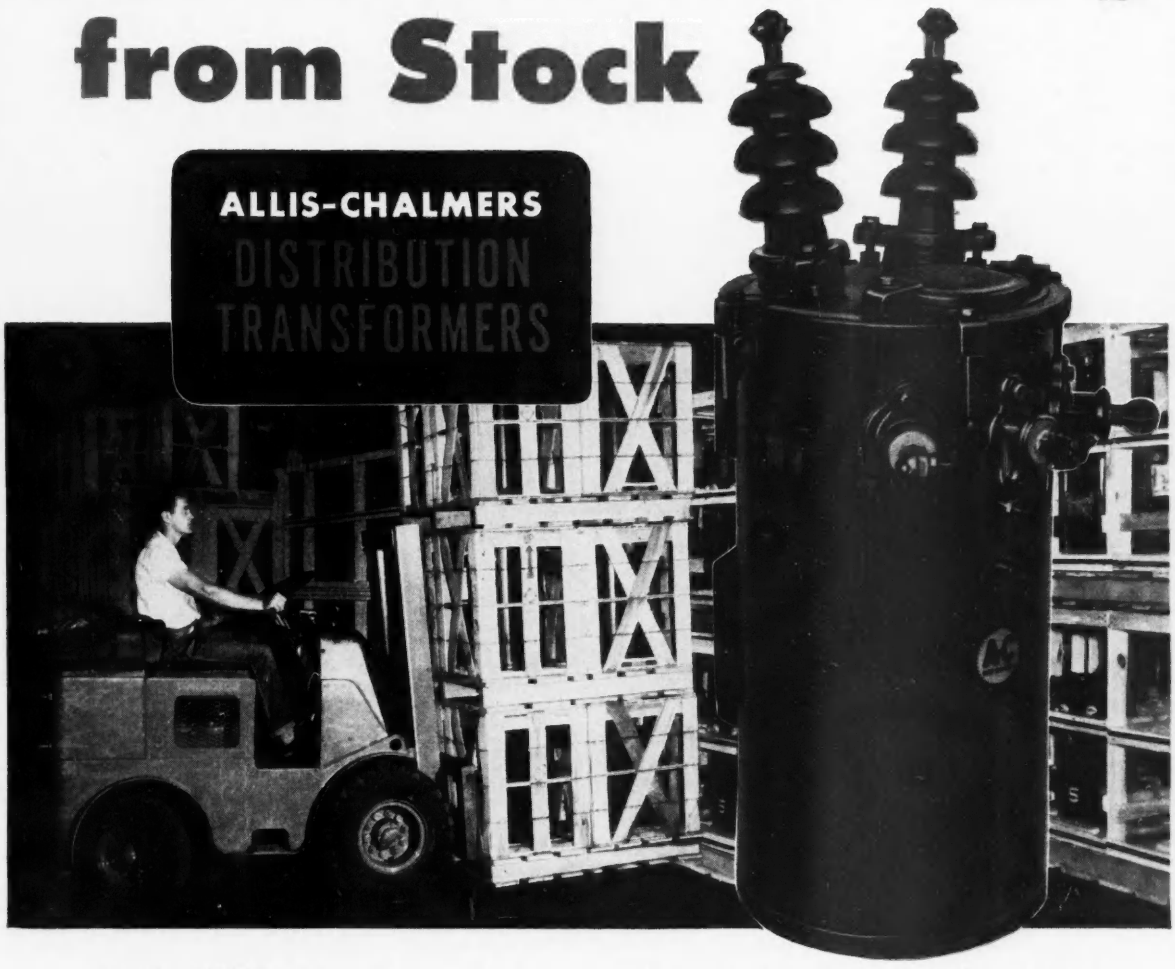
Try this remarkably tough plastic tape yourself. See how it resists weathering, moisture, acids, oils and alkalies. See how it helps *you* save! For complete facts and specifications, write Minnesota Mining & Mfg. Co., Dept. EW-113, St. Paul 6, Minnesota.

3M COMPANY

The term "Scotch" and the plaid design are registered trademarks for the more than 300 pressure-sensitive adhesive tapes made in U.S.A. by **Minnesota Mining & Mfg. Co., St. Paul 6, Minn.**— also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 E. 42nd St., New York 17, N. Y. In Canada: London, Ont., Can.

SCOTCH BRAND Electrical Tape No. 33

Immediate Delivery from Stock



GOOD NEWS! You can now get your distribution transformers out of local stock to take care of emergency situations. Allis-Chalmers offers you self-protecting and overload indicating types as well as conventional designs. All are available in most popular ratings from strategically located stock points throughout the country.

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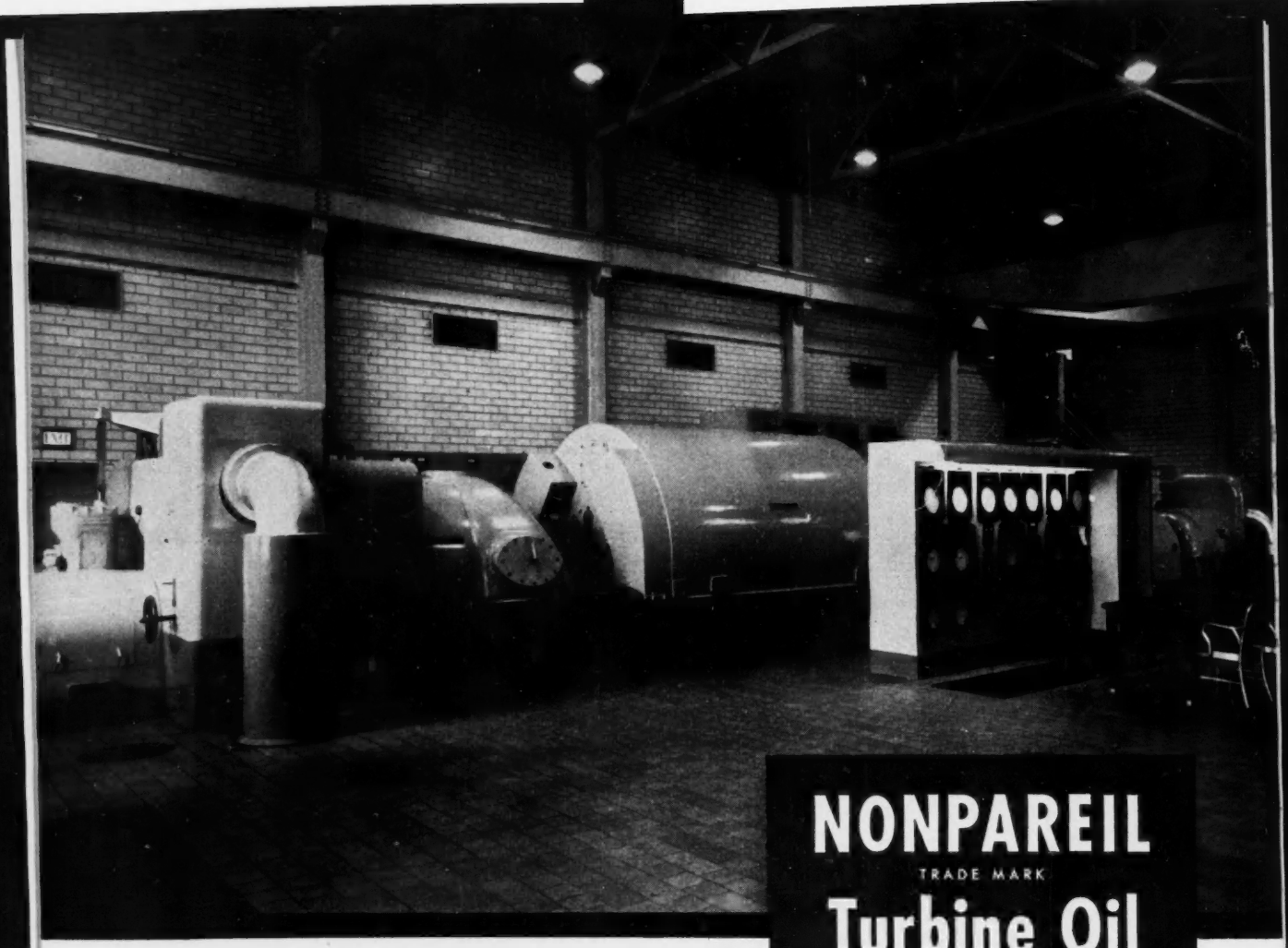

NONPAREIL
TRADE MARK
Turbine Oil

Nothing succeeds like service!

● This turbine, one of the largest industrial units in the Midwest, was recently installed by a leading paper mill. The decision of mill officials to lubricate the new turbine with NONPAREIL Turbine Oil was based on their own experience with this outstanding product.

Beginning in 1941 in one unit, NONPAREIL has since been put into additional turbines; and, today, it lubricates all turbines in this big mill. Over the period of 12 years, it has not been necessary to replace any of the original fills of NONPAREIL because of lubricant deterioration or lubrication trouble. Oil systems have stayed clean. Oil acidity has stayed below 0.07 mg. KOH/gm.

In this mill, as in power plants throughout the Midwest, NONPAREIL has sold itself into one turbine after another. That success has been the result of superior turbine lubrication service. Service records of NONPAREIL cover up to 25 years' continuous operation of individual units on original fills of oil. Moreover, this unique lubricant carries a written guarantee that it will last as long as the turbine it lubricates and that its neutralization number will stay below 0.15 mg. KOH/gm.

The Standard Oil lubrication specialist serving your section of the Midwest will be glad to show you lubrication records of NONPAREIL in installations similar to your own. You can contact this specialist by phoning your local Standard Oil office. Or, write: Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80, Illinois.

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